Urban Forest Master Plan for the City of Buffalo

Prepared for
The City of Buffalo
and
Buffalo Green Fund, Inc.

Prepared by
Davey Resource Group
Kent, Ohio

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A Division of The Davey Tree Expert Company

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1.0 Introduction

Trees are essential elements to cities. They provide a wide range of environmental and social benefits including:

- Air quality – trees improve air quality by reducing low level ozone and intercepting air pollution particulates
- Water quality – trees intercept rainfall and slow runoff
- Energy conservation – shade can reduce air conditioning costs in the summer and shielding from wind can reduce heating energy use
- Urban heat islands – shade and transpiration help to reduce high summer temperatures in cities
- Soil erosion – roots help to hold soil in place which prevents sedimentation in streams and lakes
- Noise attenuation – groups of trees can significantly reduce urban noise levels
- Visual screening – rows of trees can screen unwanted views
- Human health – improved air quality reduces respiratory illness; lower summer temperatures reduce heat stroke; and studies have shown improved healing for hospital patients housed in rooms with views of trees and green space
- Social interaction – studies have shown reduced incidence of violent crimes in neighborhoods with access to parks with trees and green space
- Recreation – Parks with trees and green space offer urban residents opportunities for recreation close to home
- Residential property value – Quality landscaping with trees can significantly increase residential property value
- Commercial property value – studies have shown a positive correlation between quality landscapes with trees and retail and office property value
- Community pride – residents of communities with quality public parks with trees and well-maintained street trees report higher levels of community pride
- History and reverence – trees in cemeteries commemorate events and celebrate lives
- Aesthetics – Trees provide blossoms in the spring and vibrant colors in autumn, and can richly compliment even the greatest architecture (Photo 1.0a)

Without trees, art and culture a city cannot be great. Buffalo, New York is a great city with rich history and a valuable urban forest.

Without trees, art and culture a city cannot be great. Buffalo, New York is a great city with rich history and a valuable urban forest. Buffalo's tree population has declined however, as funding for urban forestry operations has decreased.

Reduction in all components of Buffalo's operating budgets has been made necessary because people and businesses have been moving out of the city. To reverse this trend the City of Buffalo is working hard to improve the economic and environmental conditions of the community. The environmental and economic health of Buffalo are closely linked. Trees are an investment that appreciate in value with a small amount of maintenance. The urban forest is an asset that can help attract new residents and business to Buffalo, and if planned and cared for properly, the urban forest will more than pay for itself in economic and environmental benefits.

Photo 1.0a: Even in winter trees compliment great architecture and bring life to the city.

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The City of Buffalo is in the process of rejuvenation. This process of breathing new life into a historic city is evident in the energy of the people. It is evident in the municipal employees that work for greatness because this is their home. It is evident in the volunteers that contribute their talents because these are their neighborhoods. Trees are not the only features vital to rejuvenation, but they are an essential element. Through the combined efforts of dedicated municipal employees and visionary citizens, the reforestation of Buffalo will fuel the rejuvenation of the city.

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This document is the Tree Master Plan for the City of Buffalo. It is not intended to be a static manual or instruction book. When the tasks outlined in the Master Plan have been completed and the objectives for Buffalo's urban forest are met, the job will not be done. The ideas and goals presented in this Master Plan are intended to reverse the recent trend of a declining tree population in Buffalo, and as Olmsted and Vaux did in the late 1800's, to once again incorporate the urban forest into the design and function of the city. Recognizing that a shortage of funding is currently the largest obstacle to achieving these goals, the Master Plan will explore options of prioritizing tree maintenance and look for cooperative opportunities that can yield efficiencies and cost savings. This Master Plan should be used as a dynamic document that is frequently disassembled, updated and rebuilt with ever improving insight.

The Master Plan is focused on the natural resources of the city (primarily the trees) but it also considers the necessary human and financial resources that are essential in maintaining Buffalo's urban forest. It is relatively easy to inventory the trees in Buffalo, and to tally the funds that are available for urban forestry operations. It is much more difficult to measure the abundant dedication and creativity that is apparent in the people that plan and care for Buffalo's trees. Therefore, while this Master Plan speaks of trees, it also speaks of the vision and hopes of people.

2.0 History of Buffalo's Urban Forest

2.1 Olmsted Park and Parkway System

Buffalo has a rich urban forestry history. At the turn of the 20th century, the City was rapidly growing as a result of its location near at the terminus of the Erie Canal and the Great Lakes shipping system, and also the availability of abundant hydroelectric power from Niagara Falls, New York. The city leaders had retained noted landscape architect, Frederick Law Olmsted, to design six (6) key city parks connected by a system of boulevards called "parkways" which connected every neighborhood of the city through one unified park system. Today, the Olmsted Park and Parkway System comprises 75% of the city's parkland. A "20 year Management and Restoration Plan" is being developed which calls for reforestation and replanting of most of Olmsted's original trees and shrub plantings.

2.2 Street Tree Program

The vision of a green interconnected park system was further enhanced by the planning of the residential buildup that included tree planting at the time the streets were laid out. Early photographs show the neighborhoods with brand new houses and very young trees in front of them. As the trees matured, residential sections of the city enjoyed the many benefits that urban trees provide. The vast majority of the trees planted in the City of Buffalo were American elms. The perfect vase-shaped form created arched canopies over roadways, and tree branches grew above rooftops to shade and cool residential houses. Many current Buffalonians recall days when travel throughout the city could be accomplished without ever driving on a street that did not have a tree canopy.

During the Second World War, soldiers flying over Buffalo were amazed to see Buffalo from the air (Photo 2.2a). Many of these soldiers remarked that Buffalo appeared to be a city built in a forest. Seen from above, the only evidence of habitations beneath the trees were church steeples arising out of the residential neighborhoods. The city was appropriately nicknamed "The City of Trees"!

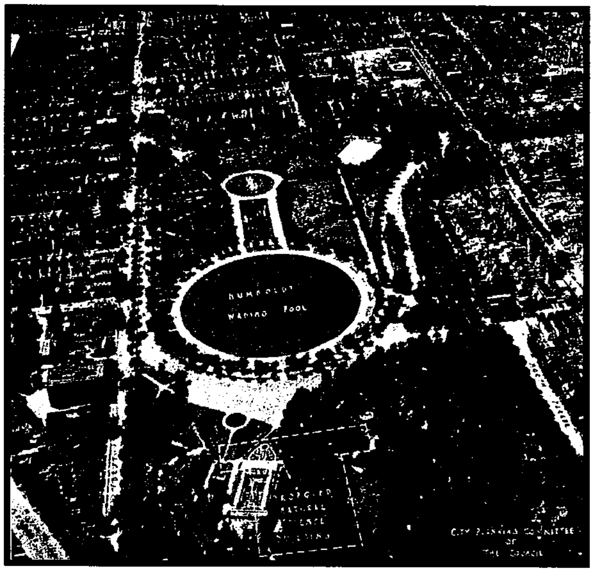

Photo 2.2a: This 1924 aerial photo of Humbolt Park and surrounding neighborhoods shows the dense tree canopy cover of Buffalo. Photo courtesy of the Buffalonian.

2.3 The Devastation of Dutch Elm Disease

Unfortunately, the stately American elms that predominated throughout the city were in essence a monoculture that exposed Buffalo to an inordinate risk of loss. When the Dutch Elm Disease hit in the 1950's, most residents hoped that a cure would be found before the trees began to die (Photo 2.3a). The first tree removed due to Dutch Elm Disease in the City of Buffalo occurred in 1959. By 1976, 95,000 American elms had died and been removed by the City Forestry Department, including many trees outside the City's right-of-way. For containment purposes, the City tried to remove all infected American elm trees.

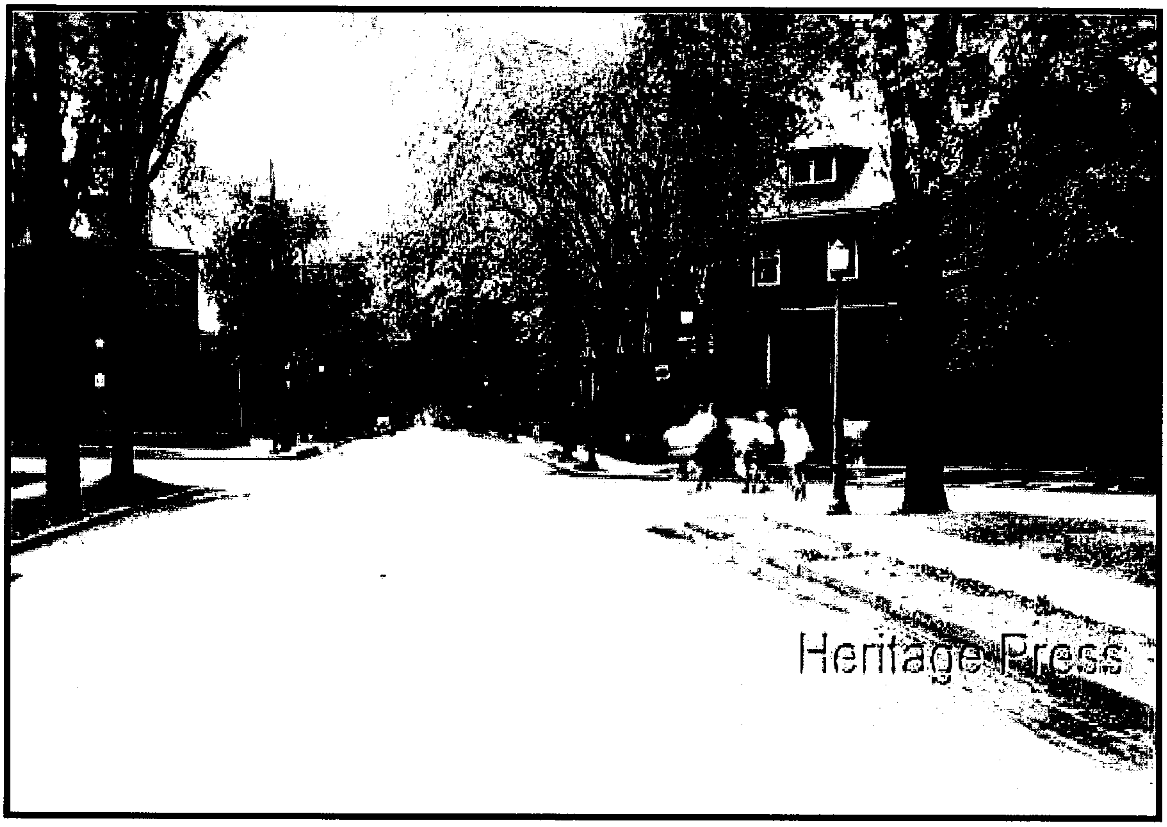

Photo 2.3a: This July 24, 1936 photo shows the arching American elm trees at the intersection of Bidwell and Delavan streets. Photo courtesy of Western New York Heritage Press, Inc.

2.4 A Visionary Replanting Plan

Fortunately for the City of Buffalo, at the time the Dutch Elm Disease struck, the City Forestry Department was one of the most respected in the Country. Legendary City Forester, Frank E. Karpick, was an expert arborist who believed that, in the future, the Dutch Elm catastrophe could be avoided through planting different species of trees throughout Buffalo. He developed a planting plan that identified sixty different species for planting on streets throughout the City of Buffalo. As elm trees were removed, new trees were planted based upon the planting plan that he and his able staff developed. After Frank E. Karpick retired, his work was carried on by other members of the forestry staff, although their numbers greatly dwindled over the years. By the late 1980's, most the diseased elms had died and had been replaced by younger trees of various species. However, tree maintenance came to a virtual standstill as successive fiscal crises within the City of Buffalo caused the city to forsake its outstanding urban forestry reputation for a policy that devastated the forestry division and reduced its numbers from a peak staff of 75 earlier in the century to zero, including no city forester!

2.5 The Rebirth of Urban Forestry in Buffalo

In the 1990's, it became clear that the city trees were in need of immediate care and attention, and wise members of city government authorized the hiring of a new City Forester, the first professional forester to serve in over ten years. The new forester was instructed to revitalize the city forestry department, purchase equipment to execute forestry tasks, and to train appropriate personnel to assist in the department of forestry. At the same time, the city had volunteer groups coalesce to form a coalition called "Reforest Buffalo" that utilized the bare root tree planting method which allowed citizen volunteers to plant trees throughout the Olmsted Parks and along streets of the City of Buffalo. Thanks to the cooperation of the City, The Buffalo Olmsted Parks Conservancy, The Buffalo Green Fund, corporate sponsors such as Praxair and M & T Bank, and volunteers, a major new replanting effort was undertaken to begin to reforest the city, starting with the Buffalo Olmsted Parks and Parkways System and extending to neighborhood and street trees as supportive block clubs, community groups, corporate sponsors and other citizen groups joined the Reforest Buffalo Coalition Group.

2.6 Buffalo's Unique Tree Places

Buffalo's rich forest history can be seen in several of the special "tree places" within the city limits. Forest Lawn Cemetery contains some of the finest specimens of North American trees located inside any city in North America (Photo 2.6a). Additionally, Frederick Law Olmsted planted his largest arboretum in Buffalo's South Park. At 156 acres, it is approximately 10 acres larger than the Arnold Arboretum laid out by Olmsted in Boston, Massachusetts. Buffalo State College, located on Buffalo's west side, has an arboretum called Maud Gordon Holmes Arboretum.

Photo 2.6a: Buffalo's Forest Lawn Cemetery contains exceptional trees and landscapes.

The campus itself has been fully reforested in the last decade and combined with the arboretum, represents an outstanding example of good urban forestry.

2.7 Tree Inventory and Master Plan

As a result of the increased interest in trees within the City of Buffalo, the city received a $75,000.00 grant from the U. S. Department of Agriculture Forest Service to do a tree inventory to assess the characteristics and quantities of the current tree population within the City of Buffalo. The grant was facilitated by the Urban Resources Partnership of Buffalo (now known as Partners in Urban Resources and the Environment or PURE) and was matched by $15,000.00 from the Baird Foundation, $150,000.00 from the City of Buffalo and $75,000 of in-kind services from The Buffalo Green Fund and the City of Buffalo Forestry Bureau. In the calendar year 2001, the street tree inventory was completed indicating that there are 106,715 possible planting sites, 67,647 that currently have trees. Overall, the survey found the City of Buffalo is blessed with a young, healthy, reasonably well-maintained tree population. This Tree Master Plan will provide recommendations and will chart a course for management of this outstanding urban tree population over the next 10 years to achieve complete reforestation of the city and bring tree maintenance levels to acceptable levels.

2.8 Conclusion

As the population of Buffalo grew in the early 20th century, so also grew the urban forest. Figure 2.8a shows the steady growth of population in Buffalo and Erie County from 1900 until 1950. Between 1950 and 1970 the population of Erie County continued to grow, but the population of Buffalo began to decline as residents moved to the suburbs. Since 1970, the population of the region has declined. During the years when the population was growing, so too was the tax base, and funding for municipal operations was usually adequate to support tree planting and maintenance operations. However, as Buffalo's population tapered off and began to decline, funding for municipal operations, including public safety, public works, and forestry also declined. According to the 2000 Census,

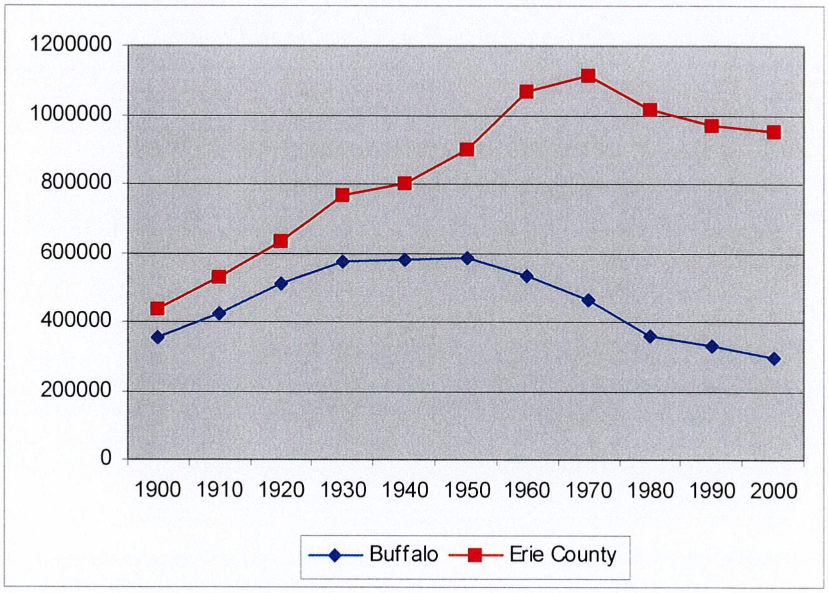

Figure 2.8a: Population of the City of Buffalo and Erie County for years 1900 – 2000

Buffalo's population dropped from 328,123 in 1990 to 292,648 residents in 2000 (a decrease of 10.8 percent). This followed a drop from 357,870 residents in 1980 (an 8.3 percent decrease). The loss of municipal tax revenue caused by this decrease in population, combined with the catastrophic loss of trees due to Dutch Elm Disease left Buffalo's urban forestry operation severely depleted.

The completion of the street tree inventory in 2001, and the assembly of this Tree Master Plan signal a revitalization of care and planning for Buffalo's urban forest. Buffalo's rich urban forestry tradition is alive and thriving after more than 100 years. Trees have added to the City of Buffalo's grace and charm from the time of Olmsted to the present. This Tree Master Plan should help chart a course for the future while avoiding or minimizing the risks inherent with trying to achieve complete reforestation.

3.0 Review of Laws and Ordinances that Affect Urban Forestry Operations

> *"The Common Council determines that trees are an exquisite and valuable resource and that Buffalo's urban forest needs nurturance and the protection of the law."*

Enacted in 1974 (and amended in 1997) Chapter 467 of Buffalo's City Code begins with "The Common Council determines that trees are an exquisite and valuable resource and that Buffalo's urban forest needs nurturance and the protection of the law." Section 467.1 A states:

> *Buffalo is aiming once again to become know as the "City of Trees," with beautiful, mature trees the norm in our city rather than the exception. For that reason, the preservation of existing tree assets and the early planting of new and/or additional trees on site is an important part of development.*

The additional points under Section 467.1 detail the benefits that urban trees provide. These sentences demonstrate the importance that the city places on its urban forest, and illustrate the commitment that the city government has regarding trees.

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This section of the Tree Master Plan will review the laws and ordinances that relate to tree establishment, maintenance and preservation. The purpose of this section is to recognize the strong legal foundation on which Buffalo's urban forestry program is built while offering recommendations intended to ease the implementation of its provisions.

3.1 Review of Section 467-1

Article 467-1 E reads:
Healthy trees should not be cut down without due consideration of the value of the tree, and when due consideration yields an overriding reason to destroy a tree, the health of the urban ecology demands that resources represented by the tree are replaced through plantings.

There is a clear legislative policy within the City of Buffalo to replace trees that are removed. Required replacement is the intent for all tree removal situations on public property. (For additional information within the City Code that deals with tree replacement, see Article 467-8A(2) of the City Code as discussed in Section 3.7 of this plan).

Article 467-1 G reads:
The convenience of clearing all trees from a piece of land and planting trees and shrubs at the end of the building process must be weighed against the resources that are destroyed in the process, and this Council wishes to foster a building process that conserves trees where possible.

This provision is useful advice for all development that occurs within the City of Buffalo. In practice, the Forestry Bureau historically exercised influence over private property trees that pose a hazard to surrounding properties or the public at large. In that instance, the owner was notified to correct the problem, or if the situation persists, taken to court through the Department of Permit and Inspection Services. With respect to public property, such as street trees, this provision imposes an obligation to preserve trees.

3.2 Review of Section 467-2

Section 467-2 defines 6 terms used in the ordinance:

Commissioner – The Commissioner of Human Serves, Parks and Recreation.

DHFF – Diameter at a height of four feet.

Permittee – One who applies for a permit for an action that may involve the destruction of live trees.

Public Agency – An agency such as a city department, which is not required to obtain a permit from the City of Buffalo for work within the city.

Shade Tree – A tree of a species that is expected to grow to a height of at least 25 feet at maturity.

Street Tree – A tree planted in the public right-of-way of any street within the City of Buffalo.

Sections 3.9.2 and 3.9.3 of this document present recommendations for updating some of these terms.

3.3 Review of Section 467-3

Section 467-3 of the City Code outlines what is permitted and what is not permitted to be done to trees growing on public property. In essence, the section says that trees on public property are not to be damaged or removed without authorization of the Commissioner of Human Services, Parks and Recreation. Residents are allowed to care for a street tree growing adjacent to their property through watering or pruning with hand tools, but only if they prune the tree according to proper pruning practices. (Section 3.9.3 of this master plan recommends the creation of an Arboricultural Standards Manual for the city in which the best management practices including pruning methods are described.) Section 467-3 also prohibits homeowners from using ladders to climb into trees while pruning. (Note: Section 309-8 prohibits climbing of park trees).

3.4 Review of Section 467-5

Section 467-5 outlines the penalties for violating the provisions of the City Code, and limits the amount of the fine to $1,500 or 15 days in jail. These civil penalties are intended to be punishment for the act of damaging or destroying a tree, but are not the civil damages that can additionally be imposed to cover the cost of replacing the damaged or destroyed tree. The civil damages are defined in Section 467-7 of the City Code and are discussed in section 3.6 of this plan.

3.5 Review of Section 467-6

Section 467-6 authorizes the creation of the Buffalo Urban Forest Fund. It states that the Fund *"shall be used to receive moneys given to the city for the planning and protection of trees."* It goes on to say, *"Such expenditures shall be directly related and limited to the procurement of trees and the necessary materials and labor to plant them."*

The Buffalo Urban Forest Fund has yet to be established, however the mechanism for its creation is already in place with the provisions of this article. Davey Resource Group recommends that the City follow through with establishment of the Buffalo Urban Forest Fund, and that it be funded by several sources, including:

- Donations for "the planning and protection of trees"
- Funds that are collected through the development application process
- Civil penalties (as discussed in section 3.4 above) collected as punishment for acts of tree damage or destruction
- Civil damages (as discussed in section 3.6 below) collected to replace trees that are wrongfully damaged or destroyed
- The difference in value between large trees that are removed or destroyed and a smaller replacement tree (as discussed in section 3.7 below)

- Offsets charged for variance to landscaping standards for new development as described in Article XXVII Section 511-146 Paragraph c(2) of the City code (as discussed in Section 3.10 below).

The establishment of the Buffalo Urban Forest Fund is an excellent opportunity to focus needed resources on reforestation efforts. It is called for by the existing City Code, and by following through with its creation the City will take an important step in improving the urban environment.

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3.6 Review of Section 467-7

Section 467-7 defines prohibited acts relative to public trees. It also states *"A conviction for a violation hereof shall not preclude a civil action brought by the city to recover full damages for the loss of or injury to such a tree, plant or shrub."*

In effect, Section 467-7 states that in addition to the maximum $1,500 fine stated in Section 467-5 (the civil penalty intended to punish the damage or destruction of trees), full civil damages can be awarded. These full civil damages are equal to the replacement value of the tree.

Section 467-7 restates the prohibited actions also presented in Section 467-3, and fines presented in Section 467-5. These sections should be organized into a single section. Also, the fines and penalties should be clarified. If a motorist destroys a tree, their insurance company should be sent a bill for the replacement cost of the tree. If a developer destroys a tree that was not to be removed, the replacement cost should be collected from a performance bond paid at the time the development permit was issued and deposited into the Buffalo Urban Forest Fund. Individual tree replacement value should be used in the determination of the civil damages amount to be paid (in addition to civil penalties).

3.7 Review of Section 467-8

Section 467-8 outlines the requirements for preservation of trees during development.

Article 467-8 A(1) includes the statement: *"...all existing trees which are of a maturity of having grown to three inches of diameter and a height of four feet (dhff)."*

Article 467-8 A(2) includes the statement: *"...the permittee or public agency must provide on-site, replacement trees, for which the combined diameter at a height of four feet (dhff) breast height, must be at least equal to the combined dhff of the trees removed."*

A straight one-for-one inch diameter replacement policy is not the best method for determining appropriate value of the removed tree. An appraisal method such as those described in the Guide for Plant Appraisal (International Society of Arboriculture, 2000) will give more appropriate results. Also, it may not be possible to plant several smaller trees in the site where one larger tree was removed. Where it is not desirable to replace a large tree with several smaller trees, a single smaller tree could be planted and the difference in value between the smaller replacement tree and the larger tree that was removed would be deposited into the Buffalo Urban Forest Fund.

Article 467-8 B(2) includes the statement: *"To maintain functional and aesthetic values, a tree (or trees) must exist or be planted on the front of each lot in the space between the sidewalk and the curb."*

While the goal to plant a tree in all spaces between the curb and sidewalk is admirable, it must be recognized that some spaces are simply too small to support a mature tree of any size. It is reasonable to require that trees be planted in all spaces as defined as adequate in an Arboricultural Standards Manual to be developed by the Forestry Bureau. It may also be reasonable to allow for delay of tree planting in front of vacant lots until such time as the lot is occupied.

Article 467-8 B(3) includes the statement: *"No tree shall be planted if the tree lawn is less than 14 inches wide."*

Minimum spacing requirements should be stated in the Arboricultural Standards Manual. Also, the minimum requirement of a 14-inch tree lawn is far too small. Davey Resource Group recommends that trees should not be planted in a space that has less than 3 feet of minimum spacing, unless unusual steps are taken to accommodate the plant. Tree lawns less than 6 feet in width should only be planted with species that mature to small dimensions.

3.8 Review of Section 467-9

Section 479-9 identifies who is responsible for enforcing the provisions of this ordinance. The departments listed include the Police Department, the Community Development Department, the Human Services, Parks and Recreation Department, and the Administration and Finance Department.

If there is to be more than one department that is responsible for enforcing laws pertaining to trees, there should be a clear understanding of which department is to take the lead on enforcement, and which departments will enforce specific articles. All of these municipal departments must be aware of their responsibilities regarding this ordinance. Coordination among the responsible departments and uniform enforcement by these departments is essential.

3.9 General Comments Regarding Provisions of Chapter 467 in the City Code

The current City Code is an admirable document that recognizes the value of Buffalo's urban forest and creates responsibility for the care of this essential resource. As with all documents pertaining to law, regular updates are needed to ensure the provisions of the law are achieving the desired results. The following sections present recommended revisions offered to clarify and focus the City Code, and to present the City Code in a manner that is easy to understand, interpret and enforce. These revisions are not intended to change the original intent of the law or to introduce new laws.

The current City Code is an admirable document that recognizes the value of Buffalo's urban forest and creates responsibility for the care of this essential resource.

3.9.1 Scope of Chapter 467

There are several articles in this chapter of the City Code that imply that the provisions of the article apply to trees on public property, but it is not implicitly stated as such (see articles 467-1G and 467-8 A(1)). At the beginning of Chapter 467 it would be helpful to have a statement such as "The provisions of the articles contained in chapter 467 of the Buffalo City Code apply to all trees, shrubs and plants growing on property owned by the City of Buffalo unless otherwise stated. Trees, shrubs and plants growing on private property are subject to local code enforcement rules"

3.9.2 Usage of Terms

In the future, if an amendment to this chapter of the City Code were undertaken, it would be advisable to update some of the terms used in the City Code to reflect current conditions. These suggested changes include:

- Replace the word ecology with the word environment. (Article 467-1E). Ecology is the study of the interaction between organisms and their environment. We believe that the intent of the reference to the "health of the urban ecology" is more accurately stated with the words "health of the urban environment".
- Replace the term Diameter at a Height of Four Feet (dhff) with Diameter at Breast Height (DBH) and caliper where appropriate. The standard forestry term for expressing diameter of trees is Diameter at Breast Height (DBH), and is measured at 4.5 feet above grade for trees greater than 4 inches in

diameter. For smaller trees, caliper is the term used for measuring diameter. Caliper is usually measured at 6 inches above ground. These standard terms and locations for determining trunk diameter should be used in the ordinance, and should be defined in the Arboricultural Standards Manual.

- Update the names of the current municipal departments. Since the City Code was written, several municipal departments have been reorganized, and areas of responsibility redefined. For example, parts of the former Human Services, Parks and Recreation Department have been reorganized into the current Department of Public Works, Parks and Streets. Each department, bureau or division named throughout City Code articles pertaining to trees should be examined for naming accuracy and current responsibilities relative to trees.

3.9.3 Creation of Arboricultural Standards Manual

Instead of defining terms within the City Code, Davey Resource Group recommends creating a separate Arboricultural Standards Manual. This manual would be used to organize all relevant information used within forestry operations including:

- Definition of forestry terms
- Recommended and prohibited tree species lists
- Planting specifications
- Pruning specifications
- Tree appraisal guidelines

The advantage to having this information in a separate standards manual is that as new standards are advanced within the arboricultural industry, the manual can be updated without requiring a modification to an ordinance. We recommend that the ordinance be modified to reference the Arboricultural Standards Manual as appropriate when and if such a manual is created.

R3.9.3 – Recommendation – Create, adopt and circulate an Arboricultural Standards Manual for use as design and review guidance by all City Departments and Boards.

3.9.4 Logical Sequence of Articles

The order in which some of the articles are presented can be improved. For example, Article 467-5 addresses the $1,500 fine and 15-day jail terms for destroying public trees. Then Article 467-6 addresses the creation of the Buffalo Urban Forest Fund. Article 467-7 returns to the topic of fines for damaged trees stating that the city can recover full damages for the loss of or injury to a tree, which might seem contradictory to Article 467-5. Perhaps the Articles would be clearer if the subjects they addressed were arranged in the following order:

- Civil penalties - $1,500 plus 15 days in jail, plus
- Civil damages – the appraised value of the damaged or destroyed tree
- Urban Forestry Fund – funds collected from penalties and damages are deposited in the Fund and used for tree establishment and maintenance.

3.10 Article XXVII – Citywide Design and Site Plan

Article XXVII of the City Code addresses the methods and requirements of reviewing and approving site plans for new developments. Section 511-137 of this article states:

> *It is desirable to establish reasonable controls over the developments which, by reason of their magnitude, may have adverse effects on adjoining uses and services provided by the city. Moreover, the aesthetics of such developments should also be subject to public review in order to preserve and enhance the quality of the built environment for generations to come.*

In addition to addressing the requirements for building specifications, traffic flow and utilities, this article addresses the need to preserve existing vegetation during development, and to incorporate suitable landscaping into the design of the site. For example, Section 511-145 paragraph J instructs a site plan to include: *"Adequacy, type and arrangements of trees, shrubs and other landscaping constituting a visual and/or noise buffer between the applicant's and adjoining lands, including the maximum retention of existing vegetation."*

Paragraph O of the same section continues: *"The project shall provide for the adequate protection of significant features and areas important to the community, including but not limited to trees...."*

This article recognizes that circumstances may require that a variance to the standard be considered. In cases where suitable and adequate landscaping or tree preservation cannot be accomplished, an option exists. Section 511-146 paragraph C(2) states: *"Where specific conditions prohibit strict adherence to this existing section, the Planning Board may, at its discretion, alter the landscaping requirements and may require a contribution to the Buffalo Urban Forest Fund."*

As discussed in the review of Section 467.6 of the City Code, the Buffalo Urban Forest Fund is authorized to receive and distribute funds that will help sustain tree-planting programs in Buffalo. Moving the Buffalo Urban Forest Fund from a conceptual idea to a functioning program is perhaps the most important next step in realizing the reforestation of Buffalo.

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R3.10 – Recommendation – The City Forestry Bureau should be involved in the site review process to determine the potential impacts on urban forestry, especially trees on public property, and to assist in the determination of tree conservation, restoration, replacement or mitigation needs and costs.

3.11 Recommendations for Revisions of Tree Related Laws

R3.11 A – Recommendation – Administer and enforce the existing policies, laws, ordinances, regulations, and technical guidance that promote, protect, restore, maintain and enhance the City of Buffalo's urban forest.

R3.11 B – Recommendation – Adjust the existing policies to ensure the optimum protection and enhancement of the City of Buffalo's urban forest such that all applicable laws and ordinances, permits, site reviews, plan reviews, and site specific development using funds of any source:

1. Be in compliance with the design standards and specifications set forth in, or to be developed as recommended by, the Buffalo Urban Forest Master Plan for the reforestation of affected public right-of-ways or other public land;
2. Include the actual or future costs of reforestation in the budgets of the development or improvements plans; and
3. Only if compliance is not possible, that the development or improvement actions be mitigated through reforestation initiatives elsewhere in the City of Buffalo.

R3.11 C – Recommendation – Adjust the policies, ordinances and regulations to recover the actual and estimated future costs of restoration and reforestation as a result of damages to trees on public property and mitigation for green infrastructure in planning design approvals.

4.0 The Relationship of Buffalo's Forestry Bureau to Other Municipal Operations

The conclusion of this section of the Tree Master Plan is best presented at the beginning: the environmental health of the City of Buffalo is dependent on the economic health of the city, and conversely, the economic health of Buffalo is linked closely to the quality of the environment. To achieve the dual goals of revitalizing Buffalo's economy and environment, cooperation between municipal agencies is essential.

...the environmental health of the City of Buffalo is dependent on the economic health of the city, and conversely, the economic health of Buffalo is linked closely to the quality of the environment.

4.1 Mayor's Office of Strategic Planning

Many of the challenges that face maintaining the existing urban forest while planting additional trees are directly related to financial resources. There is not enough money in the city budget to hire adequate personnel or contract out the needed work. In order to improve the current condition of the urban forest several hurdles must be overcome:

- Municipal funding of forestry operations should be increased
- Additional external funding sources should be sought
- Tree maintenance costs per tree should be decreased

One way to increase available funding for all municipal budgets, including forestry, is to increase the tax base of the city. This means attracting more business and residents to the city, which is the focus of several municipal departments including the Office of Strategic Planning.

The Office of Strategic Planning performs many functions in its mission to create economic, housing and quality of life opportunities in Buffalo's neighborhoods. The divisions within the Office of Strategic Planning included:

- Land Use Planning
- Information and Data Analysis
- Comprehensive and Community Planning
- Environment
- Real Estate
- Residential Development
- Economic Development

The Office of Strategic Planning also provides administrative support to City Boards and agencies including:

- Buffalo Urban Renewal Agency
- Planning Board
- Preservation Board
- Environmental Management Commission

This Tree Master plan will be of particular interest to the Divisions of Land Use Planning, Information and Data Analysis, Comprehensive and Community Planning, Environment, and Economic Development, and by association to the Planning Board and the Environmental Management Commission.

Land Use Planning is involved in site planning and site review, urban renewal planning and environmental reviews, including historical and cultural resources reviews. More specifically, this is the division that provides evaluations and recommendations for site-based tree plantings and landscaping geared toward Planning Board study and approval. The tree planting specifications and species lists contained in this Tree Master Plan will serve to supplement the design and site plan review information.

Information and Data Analysis is the home of Buffalo's geographic information system (GIS). This division played a significant role in providing the technical interface for the GIS-based street tree inventory.

Within the Office of Strategic Planning, the divisions of Comprehensive and Community Planning, and Environment, along with the Environmental Management Council, are engaged in a variety of planning activities that directly or indirectly involve green infrastructure and street trees. The Comprehensive and Community Planning Division is currently preparing for the release of a draft City of Buffalo Comprehensive Plan that promotes the integration of community, economic and environmental solutions to enhance, maintain, or improve the quality of life within the city and region. This goal of integrating community, economic and environmental solutions can be illustrated in an economic development initiative that aims to combine commercial development with cultural and green infrastructure connectivity.

An approach to increase retail business within Buffalo appears to be working. While addressing the need to revitalize neighborhood commercial districts, the draft Buffalo Comprehensive Plan notes:

> *Research shows that the increase in sales is attributable, in significant part, to consumers from surrounding suburbs shopping and dining in the City. Focus groups confirm that the reasons for this are the unique, urban character of city shopping. In particular, suburbanites enjoy the cultural diversity, the architecture, the history, and the artistic institutions that the City has to offer. As consumers, they expressed strong interest in the small, independent niche retailers located throughout the City.*

Buffalo's Office of Strategic Planning recognizes the need to integrate landscaping in city revitalization projects. In the Neighborhood Commercial Revitalization – Retail Plan chapter of the draft Buffalo Comprehensive Plan the number one development theme is "integration of retailing districts with the Olmsted Parkway System and the City's tree master plan." The description of that theme reads as follows:

1. Tree planting and greening of all retail areas in the City of Buffalo as integration with the Olmstead Parkway System.

> *Phase 1 A.*
> *Year 1: Assemble tree inventory for retail areas and update with recent changes and other existing street and landscaping details; establish design standards for these areas in collaboration with the City of Buffalo's Department of Public Works, retail area business associations as well as Good Neighbors Planning Alliance to develop a five-year retail area tree planting and greening plan and schedule in coordination with City reforestation and infrastructure improvement plans.*
>
> *Phase 1 B. Year 1 will require the securing of community tree planting federal grants.*
>
> *Phase 1 C. Year 2: Tree planting and greening streetscape of all retail areas in zip codes zip codes 14207 (3: Amherst & Grant, Niagara & Hertel, Tonawanda & Ontario), 14214 (4: Central Park Plaza, Parkside & Russell, Main & Winspear, Main & Leroy) 14215 (2: Delavan & Grider, Kensington & Bailey), and 14216 (2: Hertel & Colvin, Delaware & Hinman), TOTAL: 11*
>
> *Phase 1 D. Year 3: Tree planting and greening streetscape of all retail areas in zip codes 14213 (3: Connecticut & Richmond, Grant & Ferry, Rhode Island & Chenango), 14222 (1: Elmwood strip), 14209 (1: Main & Utica), 14208 (1: Jefferson & Ferry), and 14211 (2: Fillmore & Utica). TOTAL: 7*
>
> *Phase 1 E. Year 4:Tree planting and greening streetscape of all retail areas in zip codes 14201 (3: Allen & Elmwood, Porter & Busti, Niagara & Porter), 14202 (0) (does not include downtown), 14203 (1: Michigan and Broadway), and 14204 (3: Seneca & Chicago, Jefferson & William, Jefferson & Ferry). TOTAL: 7*
>
> *Phase 1 F. Year 5: Tree planting and greening streetscape of all retail areas in zip codes 14206 (2: Clinton & Bailey, Lovejoy & Bailey), 14210 (1: Seneca & Cazenovia), and 14220 (2: Abbott & Southside, South Park & Tifft). TOTAL: 5*

The targeted goal of improving neighborhood landscapes is to attract retail business, and by attracting retail business revenue will be brought to the city. Clearly, this is a desirable plan that is viable only through the close cooperation of the Office of Strategic Planning and the Forestry Bureau.

Fortunately, the personnel that can make such cooperation take place seem to be in place. Buffalo's City Parks Forester appears to enthusiastically carry out his responsibilities with an interest in the prosperity of his home city. (For a description of personnel assignments in the Forestry Bureau refer to section 6.1 of this document.) This type of disposition is needed if successful coordination between departments is to be realized. An interview with the Office of Strategic Planning revealed a similar level of enthusiasm for cooperatively integrating trees and landscaping into neighborhood commercial revitalization.

Having committed and motivated personnel is essential to cooperative ventures...

Having committed and motivated personnel is essential to cooperative ventures that are frequently burdened with bureaucratic turf wars. However, personnel move into and out of municipal employment, and a written set of guidelines on procedures when projects cross departmental boundaries would be helpful. To ensure the success of tree planting projects, especially those taking place in commercial districts with notoriously harsh conditions, the Forestry Bureau should be consulted early in the process of designing tree-planting sites. Simple concrete cutouts are not adequate in most cases as these sites merely serve as in-ground flowerpots for trees that fail to thrive and need replacement within 10 years. Since mature trees provide the most benefits to streetscapes, tree-planting sites need to be designed to meet the needs of the tree throughout its expected lifespan. This may require incorporation of drainage hardware, irrigation, higher volume root zones, shared soil between pits, or pervious pavement between sites. Investments in improved planting sites will prove their value by promoting larger, healthier trees with lower maintenance costs. These types of planting site considerations must be addressed early in the planning process and require the expertise of both forestry and planning personnel. The associated costs for the establishment and maintenance of trees must be included in the project budget, and should not be assumed to be covered by current forestry funding. Constructing a written set of guidelines that assigns responsibility to Forestry Bureau and Office of Strategic Planning personnel is advisable. Such guidelines should be thoughtfully constructed in a way that fosters cooperation and does not create an atmosphere of animosity.

The associated costs for the establishment and maintenance of trees must be included in the project budget, and should not be assumed to be covered by current forestry funding.

4.2 Partners for Urban Resources and the Environment

While it is not a municipal agency, the Partners for Urban Resources and the Environment (PURE Erie-Niagara) is a valuable resource to the City. The PURE Coordinator and PURE's members like their counterparts in the City's Forestry Bureau and Office of Strategic Planning have exhibited the commitment and creative talent for improving the economic and environmental atmosphere of Buffalo.

PURE Erie-Niagara has commissioned American Forests to conduct an urban forest canopy analysis using the CityGreen program. One of the findings of this analysis is that the average urban forest canopy cover in Buffalo is 12%. American Forests recommends that overall canopy cover be increased to 40% (see comments in Section 2.0 of this document pertaining to the observations of World War II pilots flying over Buffalo) with 25% cover in urban residential areas and 15% cover in the central business district.

There are a number of reasons why increasing canopy cover in Buffalo would be beneficial, including:

- Cooling of summer heat islands through shade and transpiration
- Stormwater interception and infiltration that lowers peak runoff rates (this is particularly important since Buffalo still has combined sanitary/storm sewers)
- Reduced soil erosion from vacant lots
- Improved water quality to Lake Erie, Buffalo River and Scajaquada Creek through vegetative buffers along riparian corridors
- Improved property values in residential areas (but only if the trees are properly maintained)

Even if the current street tree population were increased from occupying 64% of the available planting spaces (see section 5.3 of this document) to the recommended 85%, the percent canopy cover for the city would still be significantly lower than the 40% recommended by American Forests. This means that many more trees will need to be planted on sites other than along streets. The most favorable approach to adding tree cover in Buffalo is to encourage residents to plant trees in their yards. Since residents will be making an investment in their own trees, they will also be more inclined to care for the trees.

Another possibility of increasing canopy cover on publicly maintained lands is to plant trees on vacant lots. This option is not particularly favorable to the City for a variety of reasons. First and foremost is that current budgeting is not adequate to maintain existing street trees, not to mention trees on vacant lots. The concern stems from the fact that trees on city-owned property are the responsibility of the city's Forestry Bureau. Secondly, the goal of the City is to develop vacant lots, and it makes little sense to plant trees on land that may well be cleared for near term development. Poorly landscaped vacant lots however, contribute to a degenerative cycle. Vacant lots in neighborhoods add to the perception that the neighborhood is undesirable, leading to more vacant lots as residents and businesses leave. Just as trees are being used in commercial areas to attract new retail businesses and patrons, trees might also be used to increase the value of neighborhoods riddled with vacant lots. One approach might be to conduct pilot projects that convert a limited number of residential vacant lots into neighborhood green space. This relatively small investment may appreciably improve the image of a neighborhood and attract investors willing to purchase nearby vacant lots for development. The tree canopy cover for an average city block might be increased by 5% to 10% by the addition of one small landscaped (treed) lot. As previously mentioned, such revitalization projects should not be undertaken unless adequate funding for establishment and maintenance of the trees is included in the budget.

Once again, this is an example of environmental health leading to economic health leading to increased funding for environmental enhancement projects. Once again, the unfortunate dilemma of how to generate the initial funding needed to begin the process is encountered. Cooperative efforts between the City's Forestry Bureau and PURE Erie-Niagara may yield federal or private grants.

4.3 Department of Public Works, Parks and Streets – Division of Engineering

Trees compete for space with urban infrastructure, and this competition can be observed along almost any street in Buffalo. Approximately 98% of the street trees inventoried were adjacent to curbs, and a similar number were also adjacent to sidewalks. For most street trees the limiting factor on growth space is the distance between the curb and sidewalk. Without surprise, there are frequently conflicts for space between tree roots and sidewalks/curbs. This competition for limited space between trees and hardscape could easily lead to a competition between municipal agencies that are responsible for managing these assets. Shortsighted managers of streets/sidewalks could simply cut out tree roots wherever they come into contact with pavement. Shortsighted managers of trees could demand that pavement be removed wherever pavement comes into contact with tree roots (although tree managers in many communities find it very difficult to prevail against pavement).

Fortunately, in the City of Buffalo there is communication and cooperation between tree managers and hardscape managers. The City Parks Forester has developed a productive working relationship with the office of the Assistant Engineer for Sidewalks and Forestry. Forestry and sidewalk managers each recognize the value and necessity of both green and gray infrastructure components, and compromises are sought. Public safety cannot be compromised by severely displaced pavement or by unstable trees with severed roots. When possible, asphalt ramps are built between a raised sidewalk panel and the adjacent panel so that the tripping hazard to pedestrians is removed. In some cases, sidewalks have been diverted around trees. When the option to amend the pavement or divert a sidewalk is not a viable option, the offending tree root is removed (if it does not significantly impair the stability of the tree) or the tree is removed and the stump is ground. While both managers are protective of the assets they are responsible for, they are guided by the shared objective of improving the city for the citizens.

As well as the current cooperation between managers is functioning, the situation could be improved. Communication is always the key to cooperation, and accurate maps are valuable components to a shared language. All of the street trees have been inventoried and mapped, and the City Engineer keeps records of the location and condition of sidewalks. This information could be assembled on a common geographic information system (GIS). Ultimately, the goal should be for both the forestry and hardscape GIS layers to be accessible in both division offices so that conflicts between trees and hardscape are visible to both managers and priorities can be easily tracked. It may be possible to integrate the inventory update cycle for trees to coincide with sidewalk inspections. This efficiency could improve tree/hardscape conflict resolution and reduce inspection costs.

Communication is always the key to cooperation, and accurate maps are valuable components to a shared language.... Ultimately, the goal should be for both the forestry and hardscape GIS layers to be accessible in both division offices...

R4.3 – Recommendation – Build inter-departmental communication through shared GIS data to coordinate hardscape assessments and improvements sidewalks, street repairs, utilities, etc.) with citywide tree maintenance and planting plans.

4.4 Utility Companies and Contractors

Conflicts between trees and overhead utility wires could be handled with the same level of cooperation that is currently experienced with tree/hardscape conflicts. The complicating factor is that unlike managing city-owned hardscape, utilities are managed by private companies that do not necessarily have the same interests and objectives as does the city. Utility companies are also not as likely to share database or mapping files with the city, so opportunities for gains in efficiency are limited. In spite of these potential hurdles to cooperation, the city's Forestry Bureau currently shares a good working relationship with Niagara Mohawk, the local electric utility company. According to the street tree inventory, approximately 22% of the street trees are near overhead utility lines. This seems like a relatively low number, but represents nearly 15,000 potential conflicts. It would be beneficial to both the Forestry Bureau and Niagara Mohawk to share as much information as possible on the scheduling of line clearance operations.

Relations between the Forestry Bureau and National Fuel Gas Company, the local natural gas supplier are not as cooperative as they could be. National Fuel is required to notify the Forestry Bureau before excavation begins that affects trees, however the consistency of such communication is flawed. It is not uncommon that the Forestry Bureau only becomes aware of National Fuel excavation projects by encountering contractors on site. When tree/pipeline conflicts are evident, the contractors are interrupted, time is lost, and damage to tree roots that could have been avoided is already incurred (Photo 4.4a). Once again, shared information organized on a GIS would be helpful in identifying current excavation sites and potential tree/gas line conflicts. Ideally, an Internet based information sharing system between the City and utility companies would allow projects to be scheduled and reviewed before excavation crews arrived on site.

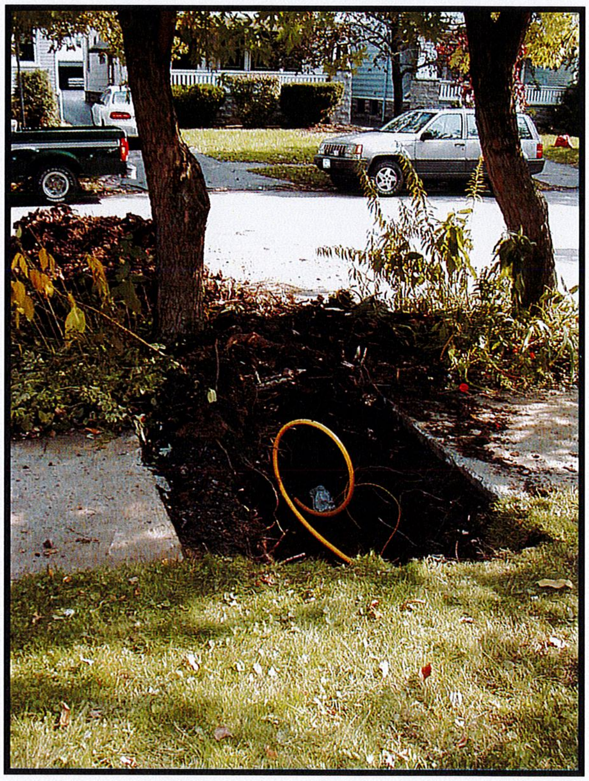

Photo 4.4a: Replacement of gas lines immediately adjacent to trees causes severe root damage. Gas line excavation should be cleared with the Forestry Bureau prior to digging.

R4.4 – Recommendation – Collaborate with utility companies on the development of a notification procedure to better coordinate utility projects with citywide tree maintenance and planting plans.

4.5 Law Department

According to section 467.9 of Buffalo's City Code, the municipal agencies charged with enforcing provisions of the code relative to trees include the Police

Department, the Community Development Department, the Human Services, Parks and Recreation Department, and the Administration and Finance Department. It may be beneficial if the Forestry Bureau were to work with the City's law department to streamline and clarify the Bureau's responsibility and authority. The Forestry Bureau should not be charged with law enforcement authority, but the Bureau should be recognized as the primary advisor to the City's legal department on issues relative to trees. The Forestry Bureau should be given the authority to shut down any construction or development projects that damage or destroy trees against the provisions of the City Code.

R4.5 – Recommendation - The City of Buffalo Forestry Bureau should be given the authority to shut down any construction or development projects that damage or destroy trees against the provisions of the City Code.

5.0 Results of the 2001 Street Tree Inventory

5.1 Inventory Summary

The City of Buffalo, New York contracted Davey Resource Group to perform a 100% inventory of trees and vacant planting spaces within the street rights-of-way of the City of Buffalo. Concluded in the fall of 2001, the major findings of Buffalo's Tree Inventory include the following:

- Davey Resource Group inventoried 106,715 tree sites in Buffalo. Of these, 67,647 are trees, 37,677 are planting sites and 1,391 are stumps.
- 5,172 sites that currently support trees were judged to be inadequate, leaving 101,543 acceptable sites, of which 67% are currently occupied by trees.
- The genus *Acer* (maple) comprises 47% of the population, followed by *Tilia* (linden) comprising 21% and *Ulmus* (elm) comprising 5% of the inventoried population.
- The distribution of trees over various size classes and species is diverse and spread fairly evenly. Small trees, which are defined as being 6 inches or less in diameter, represent 20% of the street tree population, 67% of the trees are medium-sized (between 7 and 24 inches in diameter) and 13% are large (greater than 24 inches in diameter).
- Approximately 20% of the trees were found to be in good condition, with 66% found to be in fair condition. Only 13% of the trees were found to be in poor to critical condition or dead.
- Over 15,000 (22%) of the street trees were found to have potentially hazardous conditions that require either removal or pruning to reduce risk potential to acceptable levels.
- There are 4,798 trees recommended for removal. Of these, 591 are recommended for the highest priority removal. As of this writing, there are 11,890 trees recommended for pruning associated with potential hazards. Routine Pruning is required for 38,962 trees and 10,737 trees require a Training Prune. Since the completion of the inventory, many of the highest priority tasks have already been accomplished or scheduled. The inventory database is regularly updated to reflect completed tasks and to schedule new work.

5.2 Distribution of the Street Tree Population by Growing Space

The distribution of street trees throughout Buffalo is a function of the size of the growing space available to trees. Table 5.2a summarizes the number of vacant spaces plus stumps, and the number of sites presently occupied by trees relative to the size of the growing space available. In areas where the size of the available space to grow a tree is less than 4 feet, only 48% of the sites are currently stocked. In areas where the size of the available growing space is between 4 feet and 6 feet, 60% of the sites currently support trees. And in areas where the available space for a tree is greater than 6 feet, 70% of the sites have trees. Figure 5.2b illustrates the total number of trees and the total number of vacant sites plus stumps for small (<4'), medium (4' – 6'), and large (>6') spaces along streets.

Size of Growing Space	***<4'***	***4' - 6'***	***>6'***
# Vacant sites & stumps	4331	20996	13739
# Occupied sites (trees)	3944	31840	31864
Percent stocking	***48***	***60***	***70***

Table 5.2a. Vacant site & stump count, occupied site (trees) count, and stocking percentage by growing space size.

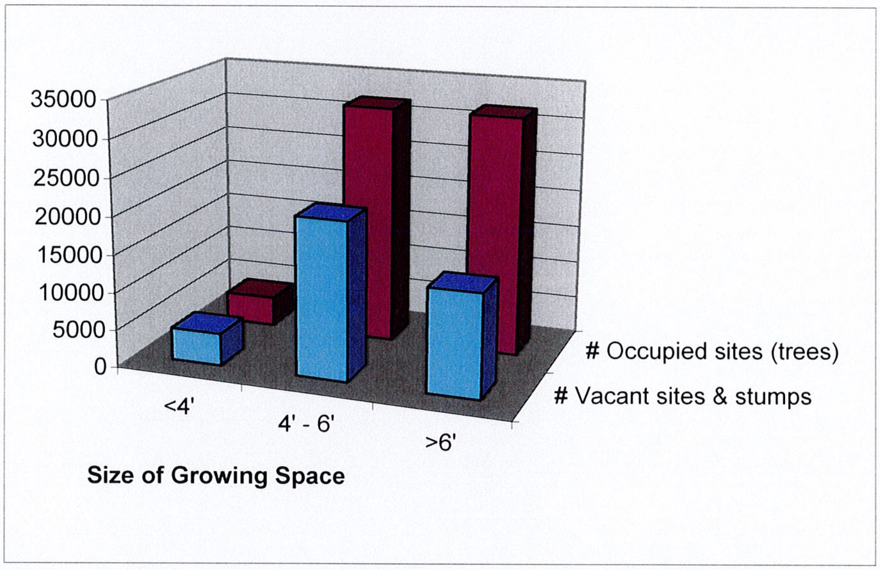

Figure 5.2b: Distribution of street trees and available planting spaces by growing space size.

Clearly, there is a strong relationship to the level of tree stocking along streets and the size of the space that is available for the trees to live in. The reason is because trees that have sufficient growing space will, in general, show less evidence of stress, will grow more vigorously, and will live longer than trees with less than sufficient growing space. The minimum amount of growing space needed to support a tree is species dependent, and there are relatively few species of desirable, long-lived trees that thrive in small spaces.

There are two primary reasons why stocking percentage is lower in areas with small sites along streets. First, trees generally do not live as long in size-restricted sites. And second, because the life expectancy of trees is less for small sites, these sites are often the last to be chosen for planting new trees. When considering return on investment, the decision to first plant trees in larger available spaces is usually the wise choice. Certainly other factors must be taken into consideration, but the economics of tree planting and subsequent survival should be given appropriate weighting.

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5.3 Historic Distribution by District

Since there is no advantage to organizing inventory data by political district, council district name is normally not an attribute gathered during the inventory process. When the initial planning for Buffalo's tree inventory began, it did not appear that there would be sufficient funding in the first year to conduct a tree inventory for the entire city. Therefore, the initial plan was to proceed through the inventory process over time by gathering data systematically moving from council district to council district as funding became available. Fortunately, funding through external grants was obtained that allowed the inventory to be completed without interruption. Because of the initial staging of the inventory, district was noted for each inventory record. Even though there are disadvantages of tracking trees by district, as will be discussed in a later section, this section takes advantage of the council district information to look at the historic distribution of trees by district. The council districts used in this discussion are based on the council district in existence in 2001.

As previously discussed, the distribution of street trees in Buffalo is a function of available growing space. Since the boundaries of districts are artificial lines that define political jurisdictions, tree stocking is not a function of district. Rather, the distribution of trees within the nine districts is a function of available growing space, and therefore the districts that have the largest growing spaces along streets also have the highest percentage of stocking. For example, as illustrated in Figure 5.3c the Delaware and Niagara districts have the highest tree stocking percentage, (82% and 76% respectively) and as can be seen in Figure 5.3a, the Delaware and Niagara districts also have a high percentage of large grow spaces (33% and 37% respectively). By contrast, the Masten and Fillmore districts have among the lowest stocking percentage at 53% and 55% respectively. These two districts also have among the highest percentage of small grow spaces (48% and 56% respectively).

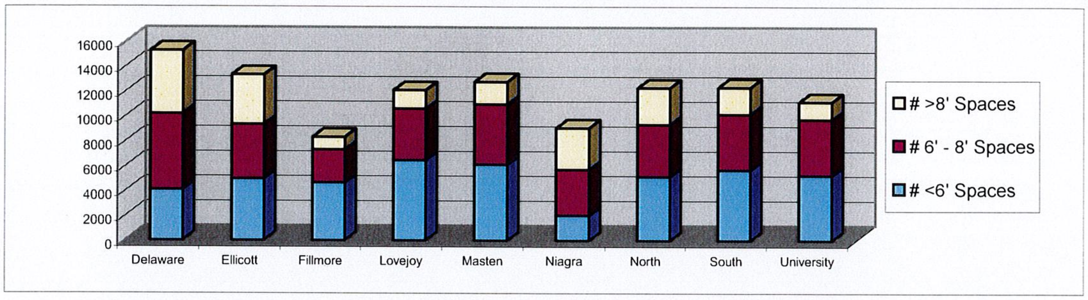

Figure 5.3a: Total number of tree sites (occupied and vacant) by size per district.

....tree stocking is not a function of district. Rather, the distribution of trees within the nine districts is a function of available growing space, and therefore the districts that have the largest growing spaces along streets also have the highest percentage of stocking.

District	*Trees*	*Planting Spaces*	*% of Sites Occupied*
Delaware	12410	2808	81.55
Ellicott	7491	5519	57.58
Fillmore	4505	3700	54.91
Lovejoy	6586	5340	55.22
Masten	6596	5869	52.92
Niagara	6847	2115	76.40
North	8298	3932	67.85
South	7018	5209	57.40
University	7897	3184	71.27
Total	***67648***	***37676***	***64.23***

Table 5.3b. Tree count, planting space count, and stocking percentage by district.

Table 5.3b shows the number of trees and available planting spaces for each of Buffalo's nine districts. Figure 5.3c graphically displays the same data. When considering the percentage of available sites that currently support trees, the districts with the best stocking levels are Delaware (82%), Niagara (76%), and University (71%). The districts with the lowest stocking levels are Masten (53%), Fillmore (55%) and Lovejoy (55%).

Considering 5,172 sites were identified that currently support trees that should not be replanted (see section 5.8 – Planting Sites), the city currently has trees in approximately 67% (roughly 2/3) of the available spaces along streets. It is important to note that without exception, all districts currently have the majority of available spaces occupied with trees. Considering the size limitations of many of the available planting spaces, it is very encouraging that over 50% of the available planting spaces are occupied in each of the nine districts.

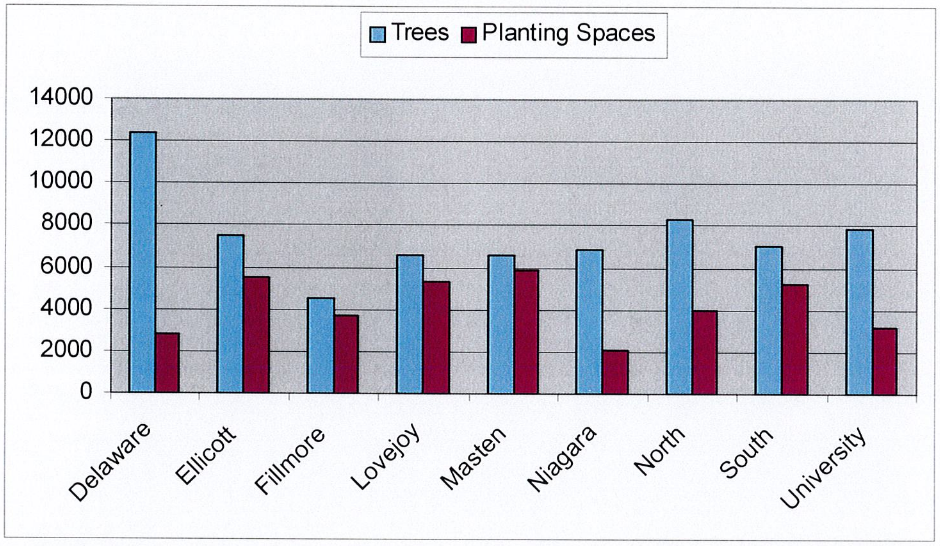

Figure 5.3c: Distribution of street trees and available planting spaces by district.

5.4 Species Diversity

As shown in Table 5.4a, six species represent over 63% of the total inventoried population. The species contributing most significantly to the tree population is Norway maple. Littleleaf linden comprises 18% of the total inventoried population, with silver and hedge maple also comprising a significant percentage of Buffalo's street tree population.

Genus Species	Common Name	Number	Percentage (%)
Acer platanoides	Norway Maple	17,605	26.0
Tilia cordata	Littleleaf Linden	11,832	17.5
Acer saccharinum	Silver Maple	7,011	10.4
Acer campestre	Hedge Maple	2,585	3.8
Acer rubrum	Red Maple	2,180	3.2
Ulmus x hollandica	Christine Buisman Elm	1,658	2.4
Total		**42,871**	**63.4%**

Table 5.4a. Street Tree Species Composition

Figure 5.4b considers all of the species within a single genus, and shows that the genus *Acer* (all maples including Norway, silver and red) comprises nearly half

(47%) of the inventoried trees. *Tilia* (lindens) comprises 21% of the population. *Ulmus* (elms) comprises 5%, while *Aesculus* (horsechestnut and buckeyes) comprises 3% of Buffalo's inventoried tree population. The remaining genera (other) comprise 24% of the population.

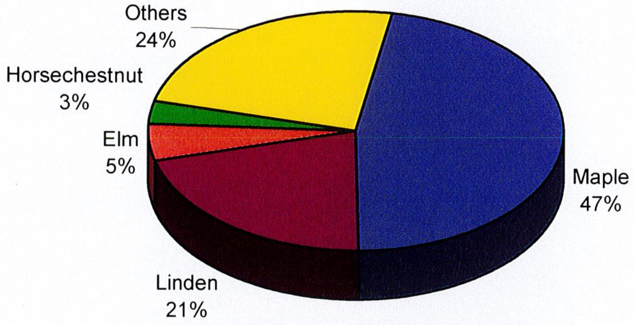

Figure 5.4b. Street Tree Genus Distribution

It is beneficial for an urban forest to have high species diversity. Diversity can decrease the impact of species-specific pests and diseases by limiting the number of trees that are susceptible. In addition, it will reduce time and money spent on mitigating any problems resulting from any such episodes. Also, a wide variety of tree species may help to limit the effects of physical events (winds, ice, water/flooding, drought, soil types etc.).

Species diversity is an important consideration in the management of a population of trees. Species diversity enables a tree community as a whole to survive natural epidemics from adverse environmental or biological factors. For a total population, it is accepted that no one species should contribute more than 10% to the total tree population and no single genus should contribute more than 30%. With this in mind, Buffalo should not plant any maples, particularly Norway maple. Littleleaf linden is also over-utilized.

5.5 Size Distribution

As illustrated in Figure 5.5a, small trees, which are 6 inches or less in diameter, represent 20% of the total tree population inventoried in Buffalo. This size class of tree includes both immature trees and mature trees of small growth habit such as crabapples.

Medium-sized trees (diameters between 7 and 24 inches) represent 67% of the street trees. The large trees (those greater than 24 inches in diameter) represent 13% of the inventoried population. While maturity class is not a direct correlation with size class, especially in small trees, it can be safely assumed that large trees are also in the mature or overmature age classes.

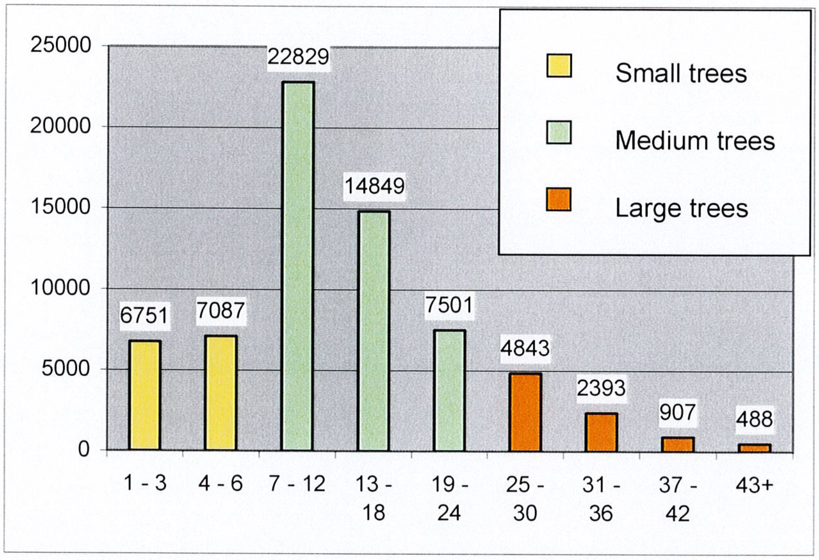

Figure 5.5a: Size Class (DBH in inches) Distribution of Inventoried Trees.

5.6 Tree Condition

The condition of a tree is evaluated by considering several factors, including the root characteristics, trunk, branch structure, canopy, foliage and presence of pests. Based on these factors, each tree is given a rating.

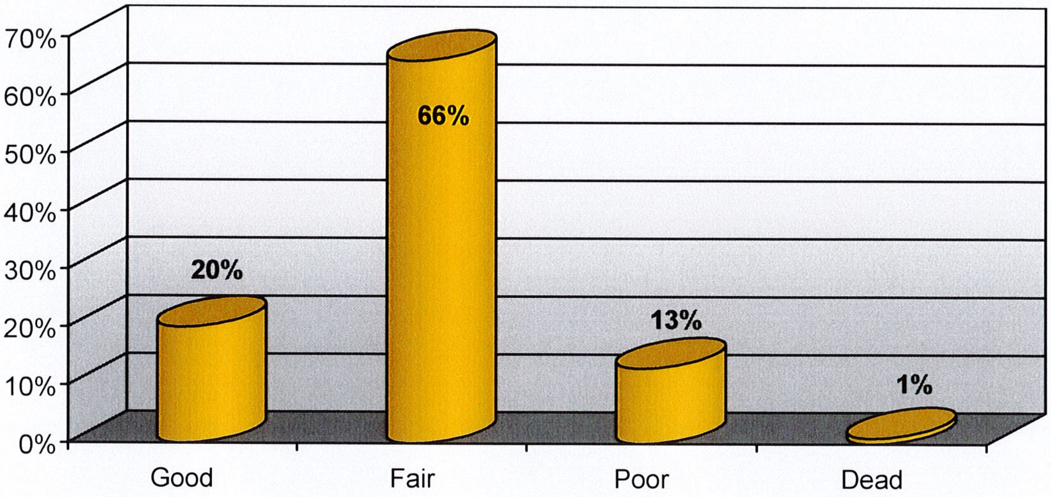

Figure 5.6a: Condition of street trees reported as a percentage.

As can be seen in Figure 5.6a, 20% of the inventoried street trees in Buffalo are in good condition. The majority of street trees (66%) are in fair condition. Trees in poor condition and dead trees represent 14% of the street trees.

5.7 Recommended Maintenance

A primary objective of the tree inventory was to determine the current appropriate maintenance needs for Buffalo's street tree population. Ensuring the safety of citizens and their property is the primary factor that determines how tree maintenance is prioritized. The decisions regarding requirements for specific pruning maintenance or removal were made by the inventory arborist based on the existence of potential hazards to people and property.

The current tree maintenance requirements have been determined from observations of the trunk, large branches and canopy of each tree. The tree inventory data was collected between March and October, 2001. It is important to note that during the street tree inventory, all observations were made from ground level – the trees were not inspected using aerial platforms or climbing. No tools such as drills, increment borers, or Resistographs were used to probe the interior of the tree for the purpose of determining the extent of internal decay. No excavation of soil was done to examine the condition of roots. Additional examination using some or all of these techniques may be needed to determine the hazard potential of individual trees.

It is important to note that during the street tree inventory, all observations were made from ground level – the trees were not inspected using aerial platforms or climbing. Additional examination may be needed to determine the hazard potential of individual trees.

Table 5.7a summarizes the recommended street tree maintenance tasks.

Maintenance Required	Number of Trees	Percentage of Trees
Removal – Priority 1	591	0.9
Removal – Priority 2	2,528	3.7
Removal – Priority 3	1,679	2.5
Prune – Priority 1	2,841	4.2
Prune – Priority 2	9,049	13.4
Routine Prune – Large Tree	31,769	47.0
Routine Prune – Small Tree	7,193	10.6
Training Prune	10,737	15.9
No Prune	1,260	1.9
[illegible]	67,647	100%

Table 5.7a: Street Tree Maintenance Requirements

R5.7 – Recommendation – The maintenance needs for Buffalo's street tree population should be based upon the street tree inventory and individual tree condition, updated as necessary, to ensure the safety of the community.

5.7.1 Hazard Potential and Risk Assessment

The maintenance activities associated with reducing the risk of injury or property damage include: Removal (Priorities 1 and 2) and Prune (Priorities 1 and 2). As illustrated in Table 3, over 15,000 street trees (22%) exhibit conditions that indicate an unacceptable hazard potential. These trees require either removal or pruning to eliminate the high-risk problem. The other maintenance activities, Removal – Priority 3, Routine Pruning for large and small trees and Training Pruning, are not high priority safety removal or pruning activities, but instead, are practices directed at improving the overall health and longevity of Buffalo's urban forest.

..over 15,000 street trees (22%) exhibit conditions that indicate an unacceptable hazard potential. These trees require either removal or pruning to eliminate the high-risk problem.

Defining what a hazardous tree is can be relatively easy, but determining if a tree is indeed hazardous can be considerably more difficult. Starting with a concise definition is useful. Nelda Matheny and James Clark have written a book entitled "A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas" (International Society of Arboriculture, 1994). In the introduction of the book, a hazard tree is defined as follows:

> *Trees are hazardous when the failure of one or more of their parts results in property damage and/or personal injury.*

They go on to note that all trees have the potential to fail and that arborists may be asked to assess their hazard potential. This evaluation of hazard potential can also be called risk assessment. Rather than determining if a tree is hazardous or is not hazardous, it is more useful to evaluate a tree for its hazard potential by closely examining it and its surroundings, and reporting on the likelihood that the tree will fail, recognizing that there is never a guarantee that any tree won't fail. Evaluating hazardous conditions in trees is not usually a black and white proposition, but rather placing the likelihood of failure and possibility of subsequent damage along a scale that ranges from black through shades of gray. Therefore, this section will briefly describe the types of evidence that indicates a tree has a condition that creates an unacceptable risk (or high likelihood of failure).

Rather than determining if a tree is hazardous or is not hazardous, it is more useful to evaluate a tree for its hazard potential by closely examining it and its surroundings, and reporting on the likelihood that the tree will fail, recognizing that there is never a guarantee that any tree won't fail.

5.7.1.1 A Hazard Requires a Target

Before exploring the causes that contribute to the failure of a tree it is important to note that the location of the tree is also an important factor. A tree's hazard potential increases as the level of human activity increases in the vicinity of a tree. Therefore, a tree located adjacent to a heavily traveled roadway will have a higher hazard potential than an identical tree in an open field. Matheny and Clark define a target as "people or property potentially affected by tree failure." If there are no targets in the vicinity of a tree then the tree has no potential to be hazardous. However, on a heavily trafficked roadway, as are common in the City of Buffalo, there are very few locations that do not have human activity taking place on at least an occasional basis.

5.7.1.2 The Size and Placement of Wood in Hazard Potential

Assuming that a tree is located near a target, how can the hazard or risk potential of that tree be determined? Many of the signs that a tree is likely to fail are readily visible even to a casual observer while other signs can be subtle, or even invisible without a close examination of the tree by a trained arborist.

Before considering the health or structural integrity of a tree, the first step in determining hazard potential is to simply look at the size and height of the wood. Small twigs have little hazard potential and large branches have large hazard potential. Large branches laying on the ground have little hazard potential and large branches high in the air have great hazard potential.

5.7.1.3 The Reasons for Failure in Trees

There are many reasons why parts of trees break and fall. Some of the factors that lead to wood failure are easily understood and others remain mostly a mystery. The physics behind wood failure are as easy as understanding that wood is heavy and gravity is a persistent force that pulls mass toward the ground. As long as the strength of the wood is sufficient to hold the weight of the wood in the air it will remain in place until the strength of the wood is weakened or a force exceeding the strength of the wood is exerted. Forces exceeding the strength of the wood can include natural forces such as wind. Forces increasing the weight of the branches beyond the breaking point can include snow or ice. Forces decreasing the strength of the wood are numerous, and some of the common forces leading to wood failure will be examined individually.

When evaluating hazard potential, it is important to have an understanding of the local climatic conditions that can affect force, weight and strength. For example, areas subject to ice and snow storms will have events that lead to destructive weight loads added to tree canopies. And areas affected by wood-chewing insects will experience tree failures due to strength loss in the wood.

5.7.1.4 Recognizing Structural Defects that Contribute to Tree Failure

Before exploring some of the external factors that affect wood strength it is important to understand features of the tree itself that affect wood strength. These features include:

- Tree species
- Tree form
- Tree age

Tree species: Individual species vary widely in wood strength and resistance to decay. Fast-growing species such as cottonwood and box elder generally have wood of lower density and strength than slow growing species such as sugar maple and white oak. In general, higher density woods are more decay resistant than lower density woods. Knowing the characteristics of the wood of a tree species is important in evaluating hazard potential.

Tree form: One of the most important factors that affects the strength of branches is how they are attached to their point of origin (a larger branch or the trunk). Branches that are attached to the trunk with a narrow "V" shaped angle typically have weak attachments and are more susceptible to breakage than those branches attached with a wider "U" shaped angle (Photo 5.7.1.4a). Evidence of included bark in the branch crotch indicates a weak branch attachment.

Some tree species, such as Bradford pear typically have many branches that originate from a short interval on the main stem. Clusters of branches, particularly those with included bark are candidates for failure (Photo 5.7.1.4b). Since Bradford pear is a relatively small tree, the hazard potential is low because of the absence of large wood at great heights.

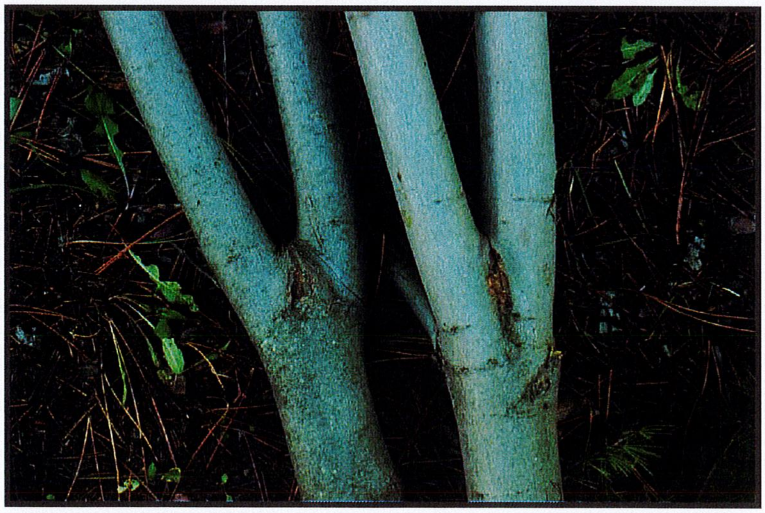

Photo 5.7.1.4a: The "U" shaped branch attachment on the left is stronger than the "V" shaped branch attachment on the right. Note the evidence of included bark in the crotch of the branch on the right.

Tree age: As with all living organisms, trees have limited life spans. The expected life span of a tree is influenced by the species characteristics, the quality of the site, the suitability of the tree for the site, and the ability of the tree to resist disease and insect infestation, which in turn is influenced by the tree's vigor. In general, as a tree reaches maturity and extends into overmaturity and decline, it becomes less resistant to the forces that decrease wood strength, such as decay. Recognizing the maturity class that a tree is in, and determining whether a tree is vigorous or in decline is important in evaluating hazard potential.

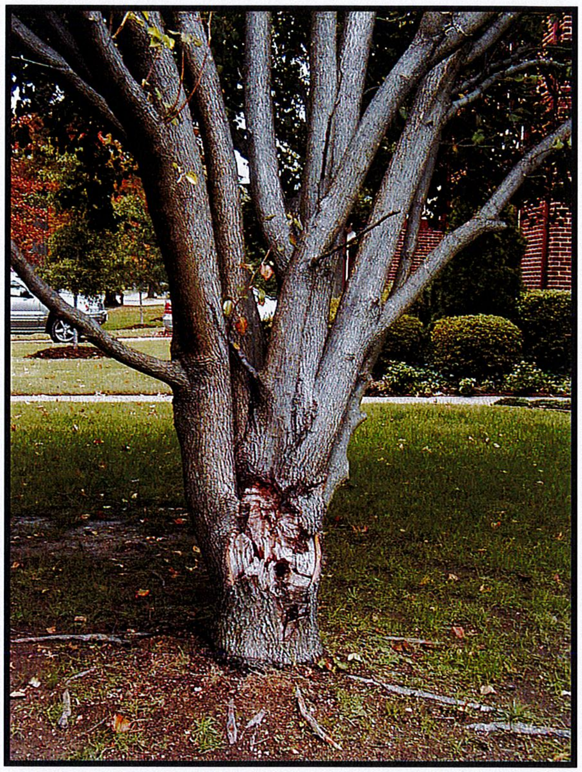

Photo 5.7.1.4b: Tree species that typically have many branches that originate from a single location on the main stem are usually prone to breakage.

5.7.1.5 External Factors that Affect Wood Strength

External factors that affect wood strength can be organized into three groups: biotic decay, biotic destruction, and abiotic factors.

Biotic decay: Living organisms, primarily fungi, decrease wood strength by chemically altering the composition of the wood, commonly referred to as decay. Fungal rots can affect any woody tissue including roots, trunk and branches. Tree failure occurs when the decay reduces the strength of the wood beyond the forces acting on the wood, primarily gravity but also wind or loading from foliage, ice or snow. The signs of decay can be obvious, subtle or invisible from the exterior of the tree. Open wounds that reveal internal decay can clearly illustrate severe problems.

Another sign of internal decay that is usually more subtle than an open wound is the presence of fungal fruiting bodies on or around the tree. Fungal conks attached to the trunk or branches of a tree indicate that internal decay is present. However it is frequently difficult to determine the stage or extent of the decay without probing the interior of the wood. Mushrooms growing at or near the base of the tree are frequently indicators of root rot. Close examination of the mushrooms by a trained arborist or mycologist is needed to identify mushrooms of wood decay fungi. Where root decay is a serious concern (root decay should always be a serious concern with large trees in areas with targets) root excavation may be needed to determine the extent of the decay.

Biotic destruction: Biotic destruction of wood usually occurs as a result of insect chewing activity, but cavity dwelling birds and animals can also excavate wood, although birds and animals usually occupy openings that have formed from decay. Chewing insects such as termites or carpenter ants can cause severe weakening of wood. Other boring insects, such as Asian Longhorned Beetle can also cause structural weakening, but can also kill a tree by destroying the cambium tissue, leading to rapid decay and wood failure.

Abiotic factors: Abiotic factors that affect strength loss in wood include all mechanical damage and breakage of limbs due to weight loading by snow or ice. Probably the most serious source of "abiotic" damage actually originates with a biotic pest, namely humans. Mechanical damage from excavation operations, lawn mowers, string trimmers, improper usage of stakes and guy wires, unmaintained tree grates, automobile doors and bumpers, and excessive pavement around the root zones cause immense but preventable damage to trees. Application of road salt and excessive piling of mulch additionally stress trees. Mechanical damage and stress cause trees to be more susceptible to insect and disease pests.

5.7.2 Tree Removals

The high number of stumps evidenced in the tree inventory and conversations with the City Forester indicate that the city has removed well over 5,000 trees in the last four years. The City of Buffalo has shown good judgment in placing a high priority on hazard tree removal as, no doubt, liability situations were avoided by the large number of recent removals. Given the total tree population and the recent period of little or no tree maintenance, this shows a tremendous effort to remove any potential hazardous trees prior to them causing problems. However, even with this aggressive, active, ongoing program, there still remain 591 Priority 1 removals.

Priority 1 removals include most of the removals over 8 inches in diameter, and should be addressed immediately as funds and equipment are available to do so. There are also 2,528 Priority 2 removals recommended which pose less of a threat, but the removal of these trees should be commenced immediately after the Priority 1 removals are completed. Priority 2 removals are mostly trees less than 8 inches in diameter. The removal of these trees will further reduce liability through the decreased likelihood of tree failure. The 1,679 trees listed a Priority 3 removal do not appear to pose an immediate threat to people or property but should be removed on a scheduled basis once the Priority 1 and Priority 2 removals are completed.

5.7.3 Priority Pruning

Priority Pruning is an important consideration in tree maintenance for maintaining tree health, for eliminating existing hazards, and for limiting the future development of hazardous conditions.

Prune – Priority 1 is the removal of dead, diseased, or obviously weak, heavy, or hazardous branches that are 4 inches in diameter or greater. As can be seen from Table 5.7a, 2,841 of the inventoried street trees are in need of Priority 1 Pruning to reduce potential hazard and liability.

Prune – Priority 2 is the removal of dead, diseased, or obviously weak, heavy, or hazardous branches that are less than 4-inches and at least 2-inches in diameter. Excessively low branches, branches that block streetlights or interfere with buildings are also included in this class. There are 9,049 trees identified requiring a Priority 2 Prune.

5.7.4 Routine Pruning

Routine Pruning is an activity that should take place on a cyclical basis for the entire tree population once all hazard removal and pruning activities have been addressed. This activity, when carried out for all trees on a five-year cycle, is extremely beneficial for their overall health and longevity. Through Routine Pruning, potentially serious problems can be avoided because the trees can be closely inspected during these pruning cycles. Proper decisions can be made on declining trees. Any trees that may be becoming potential hazards can be handled appropriately before any serious incident occurs. In all, 38,962 (58%) of the inventoried trees are current candidates for some type of routine pruning.

Through Routine Pruning, potentially serious problems can be avoided because the trees can be closely inspected during these pruning cycles.

5.7.5 Training / Small Tree Pruning

Training, or pruning to shape, consists of the removal of dead, dying, diseased, interfering, conflicting and weak branches, as well as selective trimming to direct future branch growth and lessen wind resistance on young trees less than 20 feet in height. Training pruning is used to develop a strong structural architecture of branches so that future growth will create a healthy tree. Many young trees may have branch structure that can lead to potential problems as the tree grows, such as, double leaders, many limbs attaching at the same point on the trunk, or crossing limbs. These problems can be remedied easily and inexpensively while the trees are small.

Training can be accomplished from the ground with a minimum of equipment. Training eliminates undesirable tree characteristics that could lead to more expensive large-tree pruning or removal. Examples of characteristics that should be eliminated while a tree is still young include:

- V-branches - lateral branches growing at a low angle relative to the trunk will most likely become weakly attached as the tree and branch increase in diameter, and are more likely to drop in high winds.
- Crossing branches - lateral branches that grow across the trunk or another branch, in such a way that there is or will be contact between the two, should be removed while the tree is still young. If allowed to continue, the point of contact will, most likely, begin to decay and lead to breakage.

All newly planted trees should receive their first training prune three years following planting. No training (structural) pruning should be done when the tree is planted because the tree is already under stress from transplanting, and needs as much of its leaf canopy as possible in order to manufacture food for the tree to establish in its new site. Only dead or broken branches should be removed at the time of planting. If any stakes or guy wires remain attached to the trees they should be removed at this time.

Since 20% of the City's tree population are young trees under six inches in diameter, and 10,737 trees are recommended for Training Pruning, this activity would be extremely beneficial for the overall health and quality of the urban forest. Appendix C presents recommended pruning guidelines.

5.8 Planting Sites

Within the street tree population, 37,677 potential planting sites are identified. Of the available sites, 20,974 are designated as 'small'. 'Small' sites are between three to five feet wide or sites of any width that have overhead wires. There are 8,019 'medium' sites (6-8 feet wide) identified and 8,683 'large' sites (greater than 8 feet) are identified.

The potential street tree population of the inventoried areas is 106,715 trees (67,647 existing trees plus 37,677 vacant planting sites and 1,391 stumps). However, 5,172 sites were identified that should not be replanted when the existing tree or stump is removed, leaving 101,543 acceptable sites along Buffalo's street. This means that the street tree component of Buffalo's urban forest is 67% stocked. Stocking is a traditional forestry term measuring the density and distribution of trees. The trees recommended for removal represent a future change in site status to potential planting sites, once the stumps are removed. Generally, the urban forest should be 85-100% stocked so that no more than 15% of the planting sites are vacant. An in-depth discussion of the planting plan for street trees can be found in Section 9.0 – Reforestation Plan.

6.0 Review of Current Personnel, Equipment and Finances

6.1 Personnel

Currently, the position of City Forester is vacant. Andy Rabb, whose official title is City Parks Forester handles the responsibilities assigned to the City Forester's position including supervision of contractors who work on public trees along streets and outside of parks. On paper, the difference between the City Forester position and that of City Parks Forester is primarily in the minimum qualifications concerning employment experience (8 years vs. 1 year respectively). The City Forester/City Parks Forester is supervised by the Deputy Commissioner of the Division of Parks. The Deputy Commissioner reports to the Commissioner of the Department of Public Works, Parks and Streets, and the Commissioner reports to the Mayor.

The City Parks Forester is currently responsible for supervising the Park Utility Workers and the Park Laborers. Currently there are 5 Park Utility Workers and 1 Park Laborer who are assigned to maintaining public street trees and park trees. There is also an office secretary who currently reports to the City Parks Forester. The secretary's responsibilities include processing and prioritizing citizen's phone calls and updating the tree inventory data.

6.1.1 Recommendations

The amount of tree removal and maintenance work needed in Buffalo is a compelling reason to add additional Park Utility Workers and Park Laborers. However two other positions should receive more immediate attention. First, the position of Forestry Technician/Assistant Forester should be added. The responsibilities for the Forestry Technician/Assistant Forester would include:

- Inspect and approve or reject tree removal and pruning work performed by contractors
- Conduct tree maintenance planning inspections to identify the location and extent of near-term work
- Identify potential planting sites
- Inspect and approve or reject contract tree planting immediately after trees are planted
- Identify and remove tree stakes within 1 to 2 years after planting

The second position that should be considered is the formalization of the Crew Chief designation. Currently, the Park Utility Workers do not have an identified leader who is responsible for supervising field labor. This position could potentially be filled by one of the current Park Utility Workers, so it would not necessarily require enlarging the work force. An appropriate increase in compensation would be needed however, to recognize the increase in responsibility and to inspire an increase in productivity.

Current staffing levels are insufficient to allow all of the available equipment to be operating at the same time, however work is efficiently accomplished by matching the needed equipment to the task at hand. However, if one of the field crew is absent it is difficult to configure the crews in an efficient manner. This situation happens frequently enough to be a concern, and therefore the addition of at least one Park Utility Worker or Park Laborer is also recommended.

There is much more work associated with maintaining public trees than can be managed by the current city personnel. In order to meet the current workload, additional funding is needed for contract trees crews. Projected budgets for the maintenance needs identified in the tree inventory are presented in section 8.4 of this document, and projected budgets for the coming five years are presented in section 8.5.

R6.1 .1 – Recommendation – The City of Buffalo Forestry Bureau should be staffed at a level sufficient to accomplish the necessary maintenance and planting needs stated in this plan and to further efficiently utilize optimized crew and equipment configurations.

6.2 Equipment

Currently the Bureau of Forestry operates the following mechanized equipment:

Year	Vehicle description	Unit number
1999	Versalift aerial Truck	PK 9901
1999	Versalift aerial / chipper box truck	PK 9900
1998	International dump truck model #2674	PK 9820
1997	John Deere articulated wheel loader	PK 9720
1997	Vermeer 1800 brush chipper	PK 50EQ
1997	Vermeer 1102 stump grinder	PK 51EQ
1997	Chevrolet Fleetside pickup truck	PK 9712
1998	Chevrolet 3500 1-ton dump truck	PK 9809
1991	Ford F-350 4x4 pickup truck	PK 9102

The City Parks Forester reports that the equipment in general is in good shape, and there is no immediate need to replace any units. For planning purposes it is useful to note that with the exception of the '91 pickup truck, all of the equipment is roughly the same age. This may present a budgeting problem in the future when much of the equipment will need to be replaced within several years. It may be helpful to plan for gradual replacement of the more expensive units over time. This will mean that some units are scheduled for replacement before they reach the end of their work life. This will allow for capital expenditures to be staggered over time.

R6.2 – Recommendation – The City of Buffalo Forestry Bureau should be supplied the recommended equipment sufficient to accomplish the necessary maintenance and planting needs stated in this plan and to further efficiently utilize optimized crew and equipment configurations.

6.3 Current Financial Allocation

The Bureau of Forestry's budget for fiscal year 2003 (7/1/02 – 6/30/03) is as follows:

Source	Use	Amount
Bureau of Forestry budget	Personnel	$350,179.84
Bureau of Forestry budget	Travel	$225.00
Bureau of Forestry budget	Supplies	$9,731.00
Bureau of Forestry budget	Equipment services	$117,008.15
Bureau of Forestry budget	Capital outlay	$1,145.00
Subtotal Forestry budget		$478,288.99
Tree Care Bond Account	City wide fall '02 planting	$19,402.00
Tree Care Bond Account	City wide spr. '03 planting	$51,649.95
Tree Care Bond Account	Phase III tree trimming	$50,945.00
Tree Care Bond Account	Phase III tree removal	$25,000.00
Subtotal Tree Care Bond		$146,996.95
NY State Dept. of Env. Cons. Urban & Community For Grant		$25,000.00
NY State "Main Street NY" Downtown Development Grant		$50,000.00
Subtotal grants		$75,000.00
Total forestry budget		$700,285.94

R6.3 – Recommendation – The City of Buffalo Forestry Bureau should be funded at a level sufficient to accomplish the necessary maintenance and planting needs stated in this plan to minimize liability and to further meet citywide reforestation and maintenance goals.

6.4 Comparison to Selected Cities

This section compares aspects of Buffalo's Forestry Bureau to other municipal forestry department operations. Where appropriate, national and regional statistics will be used for comparison purposes. The source of this information is the 1994 report Municipal Tree Management in the United States, funded by the International Society of Arboriculture Research Trust. The financial data is extrapolated to 2003 where appropriate. A clear picture is not always gained by comparing one city's operation to other communities across the country due to the great variation in population size, climate, maintenance requirements and costs. Data comparisons on a regional level from the above referenced report may also be unreliable due to differences in city size, cost of living, and overall development of urban forestry within the region. The 1994 report breaks the nation into geographical regions based on climate for the sake of comparison within a region. Buffalo is located in the Great Lakes - Northeast region, which includes Maine, New Hampshire, Vermont, Michigan, Iowa, and parts of Massachusetts, New York, Pennsylvania, Ohio, Indiana, Illinois and Nebraska. Specific information from cities with which Davey Resource Group is familiar will also be used for comparison. These cities were chosen for comparison purposes in order to provide a better picture of the varying ways in which cities handle their tree management. It would be impossible to find a city with the exact size and characteristics of Buffalo for comparison. Instead, each of the referenced cities is considered to be performing at least a portion of their urban forest management in a commendable way. Each also has its own problem areas. Descriptions of their successes and failures are included in this analysis both for informational purposes as well as a means to measure the various components of Buffalo's forestry operations. A brief description of each city's most commendable urban forestry program component follows. Table 6.4a presents a summary of cities used for comparison, as well as the national averages for communities of similar size to Buffalo.

City Name	**Population Size**	*# of Public Trees*
Buffalo, NY	292,648	67,647 street
Columbia, SC	110,000	45,833 street
Charleston, SC	110,000	30,000 public
Lansing, MI	125,000	46,000 street
Norfolk, VA	231,000	74,000 street
Savannah, GA	142,000	80,000 public
Fargo, ND	150,000	36,000 street
National Average	100,000-249,999	73,333 public
	250,000 - 499,999	123,567 public

Table 6.4a. Comparison cities with population size and public tree size

Both Columbia and Charleston, South Carolina have programs that are based on serving the public need on a request-by-request basis. Lansing, Michigan's program has a strong cyclical trimming component that is closely tied to its computerized tree inventory. Additionally, from work records housed in their tree management software, they have developed a set of work performance standards for each job classification to be used in measuring crew performance and forecasting work accomplishments. Savannah, Georgia is a city that has developed a successful cyclical trimming operation and also has a well organized and computerized citizen request and response system in place. Fargo, North Dakota plants on average four times as many trees as are removed. This program is carefully planned with the help of a very active volunteer committee.

The discussions that follow will compare and contrast components of each of these operations to Buffalo's system. As stated above, none of the comparison cities is considered to have an overall exemplary operation, but all have both strong and weak components that are useful for comparing to Buffalo's urban forestry program.

6.4.1 Staffing

All comparison cities employ a city forester, and supervisory personnel. One difference is the amount of seasonal or contract personnel used. Norfolk plants trees using a Parks Department crew while over half of Fargo's Forestry Department is seasonal or part time staff.

Table 6.4.1a shows the number of forestry personnel for each of the comparison cities, and the total number of public trees divided by the number of personnel to show a comparison of the number of trees maintained per crew member. Buffalo crews are responsible for more trees per crewmember than any of the comparison cities. This comparison indicates that Buffalo does need additional personnel in order to provide greater tree care services that would make the city more comparable to other cities with productive urban forestry programs.

City Name	Number of Tree Maintenance Employees	# Trees Maintained per Crewmember
Buffalo	7 fulltime	9,664*
Columbia**	8 fulltime	5,729
Charleston	5 fulltime, 1 seasonal	5,455
Lansing	15 fulltime, 3 seasonal	2,788
Norfolk	19 fulltime	3,895
Savannah	18 fulltime	4,444
Fargo	9 fulltime, 10 seasonal	2,571

(*The number of trees maintained per person within Buffalo's Forestry Bureau is based upon number of existing street trees only. Park trees are not included in this figure, nor are vacant planting sites along streets that could be planted. This number also does not reflect the number of trees removed or pruned by contract tree crews.)

(**The listed number of tree maintenance employees in Columbia does not include the tree planting crew because it is not currently involved in annual tree maintenance activities. This crew's primary responsibility during the four-month planting period is tree planting and immediate after-care and spends the remainder of the year watering and right-of-way maintenance).

Table 6.4.1a: Forestry staff size in each comparison city

6.4.2 Funding

Table 6.4.2a compares annual budgets for several city forestry departments, including all personnel, equipment, and associated costs. The per tree expenditure is important in that it provides a means of measuring how well the Buffalo urban forestry program is funded compared to other cities.

City	Annual Budget	Number of Trees	$ / Tree
Buffalo	$700,285	67,647	$10.35
Columbia	$692,867	45,833	$15.12
Charleston	$491,000	30,000	$16.37
Lansing	$1,078,000	46,000	$23.43
Norfolk	$1,490,000	74,000	$20.14
Savannah	$1,200,000	80,000	$15.00
Fargo	$741,000	36,000	$20.58

Table 6.4.2a: Annual per tree expenditures for urban forestry operations

Buffalo's per tree budget is significantly lower than all of the comparison cities, including Norfolk, Lansing, and Fargo whom have strong exemplary urban forestry programs. Norfolk's budget is 112% greater, Fargo's is 6% greater, and Lansing's is 54% greater.

Table 6.4.2b presents the per capita expenditure for tree care. Buffalo's per capita expenditure is far below the other comparison cities. Fargo's per capita expenditure for urban forestry is more than twice that for Buffalo, and Norfolk's is more than three times Buffalo's per capita expenditure.

City	Per Capita Expenditure for Urban Forestry Program
Buffalo	$2.39
Columbia	$6.30
Charleston	$4.46
Norfolk	$6.45
Lansing	$7.75
Savannah	$8.45
Fargo	$4.94

Table 6.4.2b: Comparison of per capita expenditures for Urban Forestry Programs

The fact that Buffalo's Forestry Bureau is able to serve its citizens as well as it does under these budgetary circumstances is worthy of praise. These comparisons provide strong evidence for a needed review of the Buffalo urban forestry program budget, and support for budgetary increases to enable the Forestry Bureau to implement an enhanced program that will more favorably compare to other cities nationally.

Buffalo's per capita expenditure is far below the other comparison cities. Fargo's per capita expenditure for urban forestry is more than twice that for Buffalo, and Norfolk's is more than three times Buffalo's per capita expenditure.

6.4.3 Productivity

An important consideration is the amount of work performed annually for these budget dollars. Statistics for the national average for cities in Buffalo's population range and for each comparison city are presented in Table 6.4.3a. Since Buffalo's population is near the 250,000 level both 100,000 to 249,999 and 250,000 to 499,999 ranges are presented.

City	Trees Trimmed Annually	Trees Removed Annually	Trees Planted Annually	Trees Planted: Trees Removed
Buffalo	800 – 7,500	600 – 1,200	300 - 600	0.50
Columbia	3,381	465	518	1.11
Charleston	4,000	120	400	3.33
Lansing	11,000	758	973	1.28
Norfolk	7,000	1,300	2,000	1.25
Savannah	6,200	1,000	500	0.50
Fargo	3,600	320	1,200	3.75
National Average 100,000 – 249,999	3,425	395	747	1.89
National Average 250,000 – 499,999	12,624	831	1,982	2.39

Table 6.4.3a: Comparison statistics for annual trees trimmed, removed, and planted.

As illustrated in Table 6.4.3a, the City of Buffalo's urban forestry productivity can vary widely from year to year. This is solely a function of the amount of funding that is available with which to plant, maintain and remove trees. When Tree Care Bond Account money is available and supplemented by grants, contractors can be hired to trim and remove trees that city crews cannot get to. Comparison to other cities is useful, for example the City of Lansing has an exemplary pruning program as witnessed by the 11,000 trees trimmed annually. This is explained by the fact that Lansing has an aggressive cyclical trimming program that is well organized. With such an aggressive program, the city forester has found that the number of citizen requests is relatively low with few emergencies. The Lansing program is a good example of how well routed cyclical pruning can substantially increase the number of trees maintained annually.

Perhaps the most worrisome fact illustrated by Table 6.4.3a is the low number of trees that get planted by municipal crews in Buffalo each year. It appears that 2 to 3 times as many trees are removed in Buffalo each year as are planted. This is primarily due to the fact that municipal crews have little time to plant new trees due to the responsibilities involved with maintaining existing trees. In addition to the tree population rapidly decreasing in Buffalo, the percent canopy cover is decreasing even more quickly because many large, mature trees are removed but only small trees are planted. As a result, the significant benefits that come primarily from large trees such as energy conservation and improvement to air quality are being rapidly lost. In order to reverse this trend the City of Buffalo should strive for at least two to three street trees planted for every one removed for the next 10 to 15 years. An equivalent number should be planted in parks and off-street sites. Chapter 9 of this document addresses the reforestation plan.

In addition to the tree population rapidly decreasing in Buffalo, the percent canopy cover is decreasing even more quickly because many large, mature trees are removed but only small trees are planted. As a result, the significant benefits that come primarily from large trees such as energy conservation and improvement to air quality are being rapidly lost. In order to reverse this trend the City of Buffalo should strive for at least two to three street trees planted for every one removed for the next 10 to 15 years.

It is certainly possible to reverse the trend of removing more trees than are planted. The hope lies in organizing the considerable skill and energy of Buffalo's residents. The future of Buffalo's reforestation will be realized through cooperative efforts between Buffalo's City government, non-profit organizations and inspired volunteers. The reforestation plan of this document explores those possibilities.

6.4.4 Worker Wages

A comparison of municipal urban forestry employee wages is listed below.

City	**Foreman**	**Tree Trimmer**	**Laborer**
Buffalo		$28,179 - $31,948*	$24,429 - $27,833*
Columbia	$25,317	$21,870	$17,135
Charleston	$26,000	$21,800	$16,700
Savannah	$32,918	$25,942	$21,928
Norfolk	$33,349	$23,154	$19,094

*Table 6.4.4a: Comparison of municipal urban forestry employee wages. *In the City of Buffalo the Tree Trimmer designation does not exist but is comparable to the Parks Utility Worker duties. The single Laborer in the Forestry Bureau is a class 1 designation.*

Buffalo's forestry salaries are significantly higher than the comparison cities. Good wages and benefits will make it much easier for Buffalo to retain quality employees, however these costs also make it difficult for the city to hire the needed number of employees. Higher wages and benefits for city employees make the option of contracting tree maintenance work out to private companies more attractive.

6.4.5 Urban Forestry Equipment

Each city has its own configuration of equipment, crew assignments and annual activities as described in this section. Section 6.2 details the current equipment inventory for Buffalo's Forestry Bureau. Table 6.4.5a compares Buffalo's equipment inventory with that of three other cities.

Buffalo (pop 292,648)	**Columbia, SC (pop 110,000)**	**Fargo (pop 150,000)**	**Charleston (pop 110,000)**
2 Bucket Trucks	4 Bucket Trucks	2 Bucket Trucks	3 Bucket trucks
1 Dump Truck	1 Brush Truck	2 Log Loaders	2 Dump Trucks
1 Articulated Wheel Loader	1 Pickup Truck	3 Chip Trucks	1 Boom Truck
1 Brush Chipper	1 Crew Cab Truck	2 Dump Trucks	4 Chippers
1 Stump Grinder	1 Utility Truck	1 Stump Grinder	1 Backhoe
1 1-ton Dump Truck	4 Chippers	1 Tractor	1 Scow
	1 Stump Grinder		3 Pickup Trucks
	2 Water Trucks		2 Utility Trucks
			1 Ford Taurus
			1 Stump Grinder
			2 Water Buffaloes

Table 6.4.5a: Comparison of urban forestry equipment.

Table 6.4.5a illustrates that Buffalo has comparable or less equipment than comparison communities that are much smaller in size. As discussed in Section 6.2, Buffalo currently has sufficient equipment for the present work force. However, if Buffalo's Forestry Bureau staff is increased to meet the workload, additional equipment will be needed.

6.4.6 Crew Configurations and Annual Activities

Crew configurations and annual activities of comparison cities are offered in the following sections.

6.4.6.1 Columbia, SC

The Columbia Forestry Section is currently organized around four crews that perform tree maintenance functions. An additional crew, under the Right-of-way and Reforestation Section handles all tree planting activities, including summer watering, mulching, and other duties such as roadside weed control and grounds maintenance.

Four maintenance crews are responsible for tree maintenance and removal activities for all street trees. Currently, two of these crews perform their tree trimming work with a bucket truck and chipper. The other two crews work on the ground performing elevation prunes and hauling brush. The Forestry Section is designed to run three forestry crews with three-bucket trucks, chippers and one utility ground crew. The City has had a difficult time in finding and keeping qualified forestry personnel. Like Buffalo, Columbia has fewer forestry personnel than are needed to run all of the city-owned trucks and equipment. Only two individuals are experienced qualified tree climbers. In total, the crews are comprised of seven full-time employees with one Supervisor and the Assistant Superintendent overseeing all routine activities and scheduling. The Assistant Superintendent reports to the Superintendent of Forestry and Beautification. The quality of work being conducted by the Forestry Division under the direction of these individuals is exemplary.

The organization of the Columbia operation is similar to most other municipal forestry departments. Columbia uses trim crews, removal crews and special planting crews for tree care operations.

6.4.6.2 Charleston, SC

Charleston's Forestry Division is organized around three main crews performing specific functions. Two crews are responsible for all tree maintenance and removal activities for all park and street trees. The other crew is used for planting and watering. Each crew consists of three individuals.

The tree maintenance crews perform their tree trimming work with a bucket truck and a chipper. Only one of these individuals is a qualified tree climber. In total, the crews are comprised of five full-time employees and one summer helper.

Charleston's annual work activities are unique in that one third of each year is consumed with maintenance activities for the cabbage palmetto population consisting of nearly 3,000 trees. Both crews work on the palmetto pruning activities. The need for this annual pruning is related to safety and aesthetic issues surrounding the large number of tourists that annually visit the city. The rest of the year is used to respond to accumulated resident requests for tree pruning or removal work. A large tree removal often will require all crewmembers.

6.4.6.3 Lansing, MI

The City of Lansing operates two trimming crews working together for their cyclical trimming operations. The crews are both two-person with a bucket truck, chip truck, and chipper. The bucket trucks are not equipped with chip boxes. The Lansing City Forester prefers to include chip trucks with the trimming crews rather than chipping into the bucket trucks. This enables the bucket trucks to remain on the job working when the chip trucks are full and leave the site to dump. Lansing schedules all of its removals (with the exception of emergencies), for a two-month period in the fall. The operation consists of seven employees working in close proximity. Removals are routed throughout the city so that the crews remain close. Equipment is composed of two-bucket trucks; two chip trucks, two log hauling trucks, and one log loader (clam) truck. The group works in close proximity so that the equipment can be shared as needed as the tree removals proceed.

The City of Lansing concentrates heavily on using two ground-based crews for certain trimming operations. Not only do these crews perform training pruning, and small tree trimming, but they also perform all clearance-related trimming. This involves elevating limbs for vehicle and pedestrian clearance, as well as trimming trees back from buildings, signs, and traffic signals as required. This ground-based trimming is accomplished with small chain saws, pole pruners, pole saws, and telescoping pole chain saw trimmers. The Lansing City Forester feels that the trimming performed by these crews has greatly reduced the number of citizen complaint calls, and additionally, has reduced the amount of major trimming in later years.

6.4.6.4 Savannah, GA

Savannah employs four to five, two-person trimming crews with a bucket truck with chip box and a chipper for each. Savannah employs a three-person removal crew with a fourth person added as required for flagging along major streets. They employ a 10-ton Prentice loader for removing large trunk sections. The city also owns a 10-ton crane, which is no longer operable due to frame damage caused by inexperienced operators. For any large tree removals requiring the use of a crane for large limb lowering or for loading of logs beyond the capabilities of the Prentice loader, the city rents cranes with an operator on an hourly or daily basis.

Lansing and Savannah operate a separate two-person crew to perform stump grinding at a later date.

A look at a typical private contractor crew makeup is beneficial in that these companies need to strive for the greatest efficiency for profitability. Crews normally consist of two to three members with a bucket truck and chipper and possibly a log loader. For municipal routine, street-by-street trimming contracts, a two-person crew with bucket truck and chipper is utilized. The exception is large tree removals, where a four-person crew can be dispatched. The reason for not using four person crews is that normally, one ground person can handle the work generated by two tree trimmers. A second ground person's time would not be utilized efficiently.

7.0 Establishment of Street Tree Management Areas

Tree maintenance and planting was historically tracked by councilmatic districts whose boundaries have changed as recently as May 2003. It is certainly useful to divide the city into manageable units for the purpose of planning and tracking work, but using the system of non-resource related districts presents some problems. First, and foremost, the councilmatic districts are political areas and are each represented by a different City Council member. Each councilperson has the best interest of their own district at heart, and therefore forestry work that is tracked by districts runs the risk of coming under unnecessary political pressure. Another problem with using council district lines to define forestry management areas is that district lines change periodically, and district lines may not provide the most logical boundaries for scheduling tree maintenance and removal activities.

A better way to establish useful management units within a city is to use easily identifiable physical or resource features, such as major roadways, rivers or railroads as boundaries. Ideally, the management units would be approximately the same size relative to street miles and/or tree population. Since the recommended cycle for inspecting and pruning mature trees is every 7 to 10 years, a similar number of management areas would be useful for scheduling annual routine maintenance activities. Management areas can be subdivided as needed.

Since the recommended cycle for inspecting and pruning mature trees is every 7 to 10 years, a similar number of management areas would be useful for scheduling annual routine maintenance activities.

Figure 7.0a is a street map that has been divided into a possible arrangement of five suggested management areas, as identified by the orange boundaries. Within each management area there are approximately 20,000 to 22,000 street tree sites. Each management area is further divided into two sub-management areas as identified by the blue boundaries. Within each sub-management area there are approximately 10,000 to 12,000 street tree sites. Management and sub-management areas can be numbered or named. Names should be different than the naming convention used for councilmatic districts to avoid confusion. Names could be geographic, such as northwest, central, downtown, and south, or a unit could be named for the primary roadway that runs through it such as Military, Main, Genesee, Clinton and South Park.

Another system that may have value is to use zip code areas as manage units. This system would be useful for tracking work performed at individual addresses, however, the features used for zip code boundaries often meander and are frequently minor streets that do not provide obvious boundaries such as freeways.

Before establishing the boundaries and names of forestry management areas, it will be useful to consult other municipal departments and utilities to determine if management areas exist in those operations. Davey Resource Group inquired with the Streets, Planning and Parks divisions and found that there are no clearly defined management units for those operations, however further investigation may prove fruitful. Management areas that are common across municipal departments and/or utilities increase efficiency of tracking work, especially during times of emergency, such as ice storms. The Forestry Bureau should publicize the establishment of management areas to other municipal departments and utilities to underscore the advantages of a unified system.

Management areas that are common across municipal departments and/or utilities increase efficiency of tracking work, especially during times of emergency, such as ice storms.

R7.0 – Recommendation – The City Forestry Bureau should design management units of approximately the same size relative to street miles and/or tree population, subdivided as needed, to facilitate annual routine maintenance.

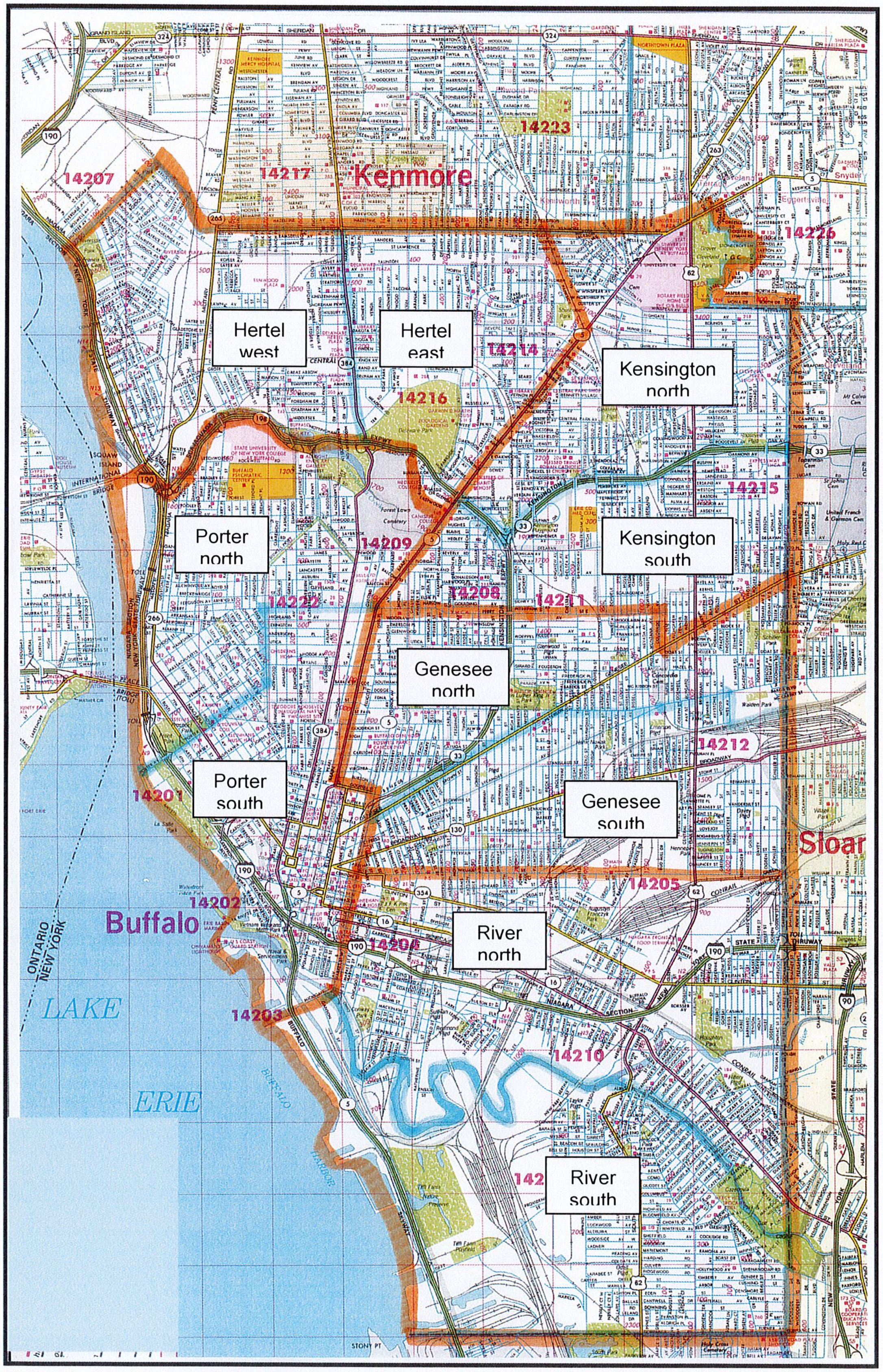

Figure 7.0a: Proposed urban forestry management and sub-management areas.

8.0 Prioritization of Current Tree Maintenance Needs

8.1 Priority Removals

As previously noted, the most important tree maintenance task is the removal of trees that present unacceptably high risks. Buffalo's Forestry Bureau has done an admirable job of attempting to keep up with the high priority removals, but the magnitude of the responsibility is larger than the capabilities of the current staff. Additional manpower, whether through contracting or hiring additional employees, is needed. Table 8.1a lists the number of removals by priority and size class. The projected budget is presented based on per unit costs provided by the Forestry Bureau.

8.2 Priority Pruning

Large dead or broken limbs are unacceptable hazards, particularly along streets. Trees identified as in need of Priority 1 and Priority 2 pruning should be addressed with the same sense of urgency that Priority removals are undertaken. The good news is that correcting the problems associated with dead or broken limbs can usually be accomplished more quickly and at less expense that removals. Table 8.2a lists the number of Priority 1 and Priority 2 prunings by size class. The projected budget is presented based on per unit costs provided by the Forestry Bureau.

8.3 Routine Maintenance

Given the magnitude of the work needed to reduce potential tree-related hazards, it would be easy to overlook the routine maintenance needs of the 49,700 street trees without apparent defects. However, the most cost effective and efficient way to prevent hazardous conditions from occurring in trees is to employ a program of routine inspections and maintenance. If the City of Buffalo is to reduce future hazard mitigation costs (and litigation costs) associated with trees, a systematic approach to regular maintenance must be initiated. Therefore, while the most immediate needs of Priority removals and prunings must come first, routine inspection and pruning should also begin.

Table 8.3a lists the number of Routine Large, Routine Small and Training prunings by size class. The projected budget is presented based on per unit costs provided by the Forestry Bureau.

.....the most cost effective and efficient way to prevent hazardous conditions from occurring in trees is to employ a program of routine inspections and maintenance. If the City of Buffalo is to reduce future hazard mitigation costs (and litigation costs) associated with trees, a systematic approach to regular maintenance must be initiated.

8.4 Projected Budgets

Tables 8.1a, 8.2a, and 8.3a project the budget for each maintenance category by tree diameter class.

Maintenance	*DBH Class*	*# of trees*	*$ per unit*	*$ per DBH class*
Removal - Priority 1	1 - 3	1	$50	$50
	4 - 6	15	$100	$1,500
	7 - 12	86	$155	$13,330
	13 - 18	126	$292	$36,792
	19 - 24	147	$385	$56,595
	25 - 30	115	$500	$57,500
	31 - 36	66	$700	$46,200
	37 - 42	21	$790	$16,590
	43 +	14	$1,000	$14,000
Sub total		*591*		*$242,557*
Removal - Priority 2	1 - 3	6	$50	$300
	4 - 6	178	$100	$17,800
	7 - 12	594	$155	$92,070
	13 - 18	516	$292	$150,672
	19 - 24	552	$385	$212,520
	25 - 30	408	$500	$204,000
	31 - 36	182	$700	$127,400
	37 - 42	66	$790	$52,140
	43 +	26	$1,000	$26,000
Sub total		*2528*		*$882,902*
Removal - Priority 3	1 - 3	532	$50	$26,600
	4 - 6	370	$100	$37,000
	7 - 12	464	$155	$71,920
	13 - 18	153	$292	$44,676
	19 - 24	85	$385	$32,725
	25 - 30	56	$500	$28,000
	31 - 36	14	$700	$9,800
	37 - 42	4	$790	$3,160
	43 +	1	$1,000	$1,000
Sub total		*1679*		*$254,881*
Total - Removals		**4,798**		**$1,380,340**

Table 8.1a: Projected budget requirements for inventory identified removals.

Maintenance	***DBH Class***	***# of trees***	***$ per unit***	***$ per DBH class***
Pruning - Priority 1	1 - 3	2	$20	$40
	4 - 6	5	$20	$100
	7 - 12	95	$50	$4,750
	13 - 18	418	$55	$22,990
	19 - 24	775	$73	$56,575
	25 - 30	829	$87	$72,123
	31 - 36	447	$88	$39,336
	37 - 42	166	$110	$18,260
	43 +	104	$150	$15,600
Sub total		*2841*		*$229,774*
Pruning - Priority 2	1 - 3	5	$20	$100
	4 - 6	136	$20	$2,720
	7 - 12	1413	$50	$70,650
	13 - 18	2398	$55	$131,890
	19 - 24	2249	$73	$164,177
	25 - 30	1507	$87	$131,109
	31 - 36	810	$88	$71,280
	37 - 42	329	$110	$36,190
	43 +	202	$150	$30,300
Sub total		*9049*		*$638,416*
Total - Priority Prunings		**11890**		**$868,190**

Table 8.2a: Projected budget requirements for inventory identified priority prunings.

Maintenance	*DBH Class*	*# of trees*	*$ per unit*	*$ per DBH class*
Pruning - Large Tree Routine	1 - 3	1	$20	$20
	4 - 6	1336	$20	$26,720
	7 - 12	13839	$50	$691,950
	13 - 18	9774	$55	$537,570
	19 - 24	3573	$73	$260,829
	25 - 30	1913	$87	$166,431
	31 - 36	871	$88	$76,648
	37 - 42	321	$110	$35,310
	43 +	141	$150	$21,150
Sub total		*31769*		*$1,816,628*
Pruning - Small Tree Routine	1 - 3	3	$20	$60
	4 - 6	1278	$20	$25,560
	7 - 12	4575	$50	$228,750
	13 - 18	1233	$55	$67,815
	19 - 24	92	$73	$6,716
	25 - 30	9	$87	$783
	31 - 36	3	$88	$264
	37 - 42	0	$110	$0
	43 +	0	$150	$0
Sub total		*7193*		*$329,948*
Pruning - Training	1 - 3	5925	$20	$118,500
	4 - 6	3526	$20	$70,520
	7 - 12	1285	$50	$64,250
	13 - 18	0	$55	$0
	19 - 24	0	$73	$0
	25 - 30	1	$87	$87
	31 - 36	0	$88	$0
	37 - 42	0	$110	$0
	43 +	0	$150	$0
Sub total		*10737*		*$253,357*
Total - Routine Prunings		**49699**		**$2,399,933**

Table 8.3a: Projected budget requirements for inventory identified routine prunings.

8.5 Five-Year Maintenance Plan

Almost $2,000,000 is needed to accomplish Priority 1 and 2 removals and Priority 1 and 2 prunings. Given the current level of staffing and funding, it is not likely that these four essential tasks will all be completed within the next year. However it is essential to prepare a plan that will accomplish the highest priority tasks within a specific time frame. Therefore, Davey Resource Group recommends that a five-year time frame be targeted to complete the tasks associated with hazard mitigation, and that subsequent years include budgeting for initiating a program of routine maintenance. Planning for planting activities will be addressed in Section 9.

At the time of the inventory there were 3,119 Priority 1 and Priority 2 removals. If all of these trees are to be removed within a three-year target period, approximately 1,040 trees will be removed annually.

During the coming years, additional trees will die and will also need to be removed. Assuming a 2% annual mortality rate, the City should expect to have an additional 1,350 trees that need to be removed each year. Assuming that only half (675) of these dead trees will be potentially hazardous, the City should plan for approximately 1,715 tree removals for each of the next three years. Table 8.4 projects the needed financial resources for 2003 removals.

The inventory identified 11,890 trees in need of Priority 1 or Priority 2 pruning. If all of these trees are to be pruned within a three-year target period, approximately 3,960 trees will be pruned annually. Assuming that 1% of the remaining tree population develops conditions that need priority pruning on an annual basis, the City should expect to prune an additional 675 trees annually. Therefore, a minimum of 4,635 street trees should be pruned each year if only hazardous conditions are to be corrected. Table 8.5a projects the needed financial resources for Year 1 prunings.

Now that the city has a detailed street tree inventory system, it is important to maintain the database and regularly update the inventory records. Therefore the annual budget for forestry operations should also include funding for re-inventory of 20% of the street tree population so that each tree is inspected every 5 years.

Year 1 Maintenance Activity	***Number Projected***	***Estimated Cost Per Unit****	***Projected Cost***
Tree removal (Priority 1 & 2)	1,715	$360	$617,400
Hazard tree trimming	4,635	$73	$338,355
Inventory update	20,300	$3	$60,900
Total ***average cost per unit of Priority 1 & 2 removals and prunings**			**$1,016,655**

Table 8.5a: Year 1 Budget Projection.

During the second year of implementing this management plan, 1/3 (560) of non-hazard (Priority 3) removals should be performed in addition to the second third of the Priority 1 and 2 removals. A mortality rate of approximately two percent of the population could be expected, therefore those removals are also be included in the budgeting. Half of these are included in the Priority 1 & 2 removals and half (675) are added to the 560 Priority 3 removals. Table 8.5b presents Year 2 budget projections.

Year 2 Maintenance Activity	***Number Projected***	***Estimated Cost Per Unit****	***Projected Cost***
Tree removal (Priority 1 & 2)	1,715	$360	$617,400
Hazard tree trimming	4,635	$73	$338,355
Tree removal (Priority 3)	1,235	$152	$187,720
Inventory update	20,300	$3	$60,900
Total *average cost per unit of Priority 1 & 2 removals, Priority 1 & 2 prunings, and Priority 3 removals.			**$1,204,375**

Table 8.5b: Year 2 Budget Projection.

During the third year of implementing this management plan, the final 1/3 of Priority 1 & 2 removals should be performed. A mortality rate of approximately two percent of the population could be expected therefore those removals should also be performed. The final 1/3 of Priority 1 & 2 prunings is accomplished. And the second third of Priority 3 removals are completed. Table 8.5c summarizes these costs.

Year 3 Maintenance Activity	***Number Projected***	***Estimated Cost Per Unit****	***Projected Cost***
Tree removal (Priority 1 & 2)	1,715	$360	$617,400
Hazard tree trimming	4,635	$73	$338,355
Tree removal (Priority 3)	1,235	$152	$187,720
Inventory update	20,300	$3	$60,900
Total *average cost per unit of Priority 1 & 2 removals, Priority 1 & 2 prunings, and Priority 3 removals.			**$1,204,375**

Table 8.5c: Year 3 Budget Projection.

The fourth year of the plan should experience a decrease in funding needed for correcting hazardous conditions. By this time the Priority 1 and 2 removals identified in the inventory will be completed. This will allow the cycle of routine maintenance to commence.

Once again, assuming 2% mortality, the city should expect to have approximately 1,350 removals. In Table 8.7, half of these are shown as the higher cost Priority 1 and Priority 2 removals and half are shown as priority 3 removals. To these are added the final third of Priority 3 removals identified from the inventory.

By the forth year, all of the Priority 1 and 2 prunings identified in the inventory will have been completed, but it is reasonable to presume that broken branches needing prompt attention will continue to occur. Assuming that 1% of the remaining tree population develops conditions that need priority pruning on an annual basis, the City should expect to prune an additional 675 hazardous trees annually. These are shown as Priority prunings in Table 8.5d.

With fewer hazard conditions to contend with, the city will have greater personnel and financial resources to direct toward routine pruning. Assuming that mature tree pruning will be conducted on an 8-year rotation, the city can expect to prune approximately 3,970 large trees and 900 small mature trees each year. Assuming that pruning to train immature trees is conducted on a 5-year rotation, the city can expect to prune approximately 2,150 trees each year. Table 8.5d shows these projected costs.

Year 4 Maintenance Activity	***Number Projected***	***Estimated Cost Per Unit****	***Projected Cost***
Tree removal (Priority 1 & 2)	675	$360	$243,000
Hazard tree trimming	675	$73	$49,275
Tree removal (Priority 3)	1,235	$152	$187,720
Routine pruning, large tree	3,970	$57	$226,290
Routine pruning, small tree	900	$46	$41,400
Training pruning	2,150	$24	$51,600
Inventory update	20,300	$3	$60,900
Total *average cost per unit of Priority 1 & 2 removals, Priority 1 & 2 prunings, Priority 3 removals, Routine Large, Routine Small & Training prunings.			**$860,185**

Table 8.5d. Year 4 Budget Projection.

By the fifth year of this plan, all of the removals and hazard prunings identified in the inventory will have been completed. The city will continue to experience trees in need of removal and in need of hazard pruning, but the numbers should gradually diminish and level off over time as a routine pruning cycle is implemented. Table 8.8 assumes 2% mortality per year, divided between hazard removals (Priority 1 & 2) and non-hazard removals (Priority 3). One percent of the trees are projected to need immediate hazard pruning, and the 8-year cycle for pruning mature trees will continue. The five-year cycle for training immature trees will also continue.

Year 5 Maintenance Activity	***Number Projected***	***Estimated Cost Per Unit****	***Projected Cost***
Tree removal (Priority 1 & 2)	675	$360	$243,000
Hazard tree trimming	675	$73	$49,275
Tree removal (Priority 3)	675	$152	$102,600
Routine pruning, large tree	3,970	$57	$226,290
Routine pruning, small tree	900	$46	$41,400
Training pruning	2,150	$24	$51,600
Inventory update	20,300	$3	$60,900
Total *average cost per unit of Priority 1 & 2 removals, Priority 1 & 2 prunings, Priority 3 removals, Routine Large, Routine Small & Training prunings.			$775,065

Table 8.5e: Year 5 Budget Projection.

The most difficult part of moving past the backlog of hazard reduction work is allocating the necessary funding. However, as can be seen in Figure 8.5f, maintenance expenses will decrease once a system of routine maintenance is in place. As a routine cycle of maintenance is implemented and hazardous conditions associated with trees are reduced, costs from litigation associated with tree-related claims should also be reduced. These savings can be added to the expected decrease in tree maintenance costs.

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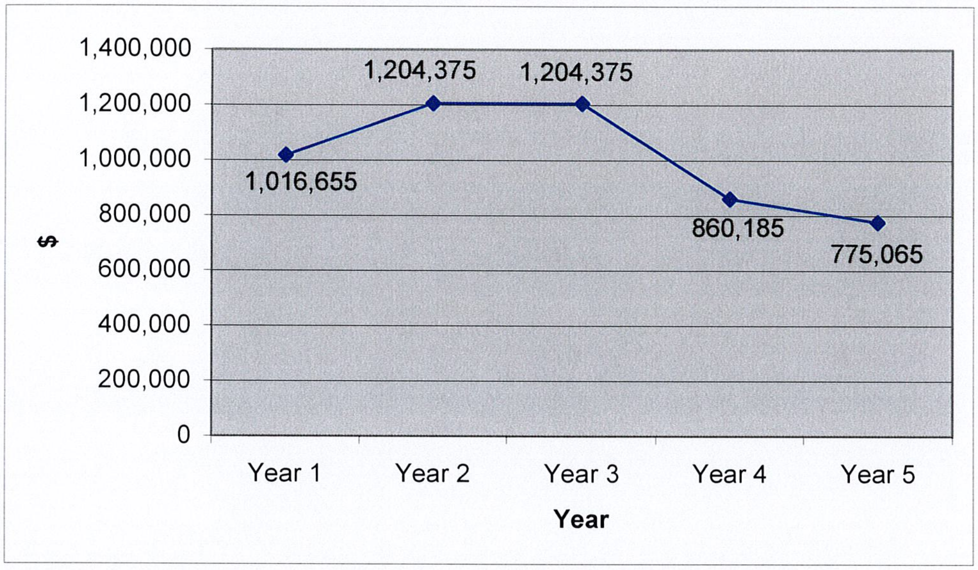

Figure 8.5f: Projected annual tree maintenance costs for five years.

R8.5 – Recommendation – A 5-year maintenance plan should be adopted and funded to accomplish the high priority tasks established in this report in order to catch up with maintenance needs and balance the street tree population for future rotational maintenance.

9.0 Reforestation Plan

Cities are improved by the addition of healthy trees. Trees remain healthy and continue to be assets to the community if they are maintained. However, trees decline and become liabilities to the community if they are not adequately maintained. Therefore, the first rule of planting trees in cities is do not plant a tree if the tree will not be maintained. Planting trees that will not be maintained wastes resources, including money.

…the first rule of planting trees in cities is do not plant a tree if the tree will not be maintained…. trees that are maintained generally appreciate in value and provide increasing benefits as they grow toward maturity. When considering return on investment, the proper tree in the proper location is a wise investment.

On the other hand, trees that are maintained generally appreciate in value and provide increasing benefits as they grow toward maturity (Photo 9.0a). When considering return on investment, the proper tree in the proper location is a wise investment.

Photo 9.0a: Residential streets with well maintained trees typically have higher property values than similar streets without trees.

Currently, trees occupy approximately 67% of the available acceptable sites along Buffalo streets. While 100% stocking will never be achieved, a practical stocking level of 85% should be targeted. The additional canopy cover along Buffalo streets will provide a range of benefits including temperature moderation, increased property value, more desirable neighborhoods, and possibly even lower crime.

A recent Urban Ecosystem Analysis conducted by American Forests for the Buffalo-Lackawanna region has concluded that increasing tree canopy cover could provided substantial environmental benefits. This study notes that Buffalo currently has 12% canopy cover, and these trees annually remove 335,000 pounds of pollutants from the city's air. According to American Forests this benefit can be valued at $826,000. Of much larger financial value is the benefit that the city's trees provide to annual reduction in stormwater runoff. The study suggests that $34.3 million worth of stormwater management infrastructure is avoided because the city's trees capture and slow stormwater runoff and significantly reduce peak flow. The study suggests that these benefits can be significantly increased by improving the total tree canopy cover within the city, and American Forests recommends a goal of 40% overall canopy cover. This goal will only be accomplished by planting trees on both public and private properties. One large step toward accomplishing this goal is to increase the stocking percentage of street trees in available spaces to 85%.

An increase to 85% stocking for street trees will require planting an additional 23,000 trees, plus replacing every tree that is removed from the current street tree population. This reforestation goal will not be achieved in a single year, but could conceivably be realized within ten years if an aggressive tree-planting program were to supplement current efforts. This chapter of the Tree Master Plan will outline the steps needed to implement such a program.

R9.0 – Recommendation – A 10-year reforestation plan should be adopted and funded to accomplish the reforestation goals established in this report.

9.1 Species Selection

The City of Buffalo has a number of variables that make the selection of trees critical and at times difficult. First and foremost among these variables is the local climate. Buffalo is in zone 5b of the USDA Plant Hardiness Zone Map, meaning that the average annual minimum temperature is –10 to –15 degrees Fahrenheit. The city's proximity to Lake Erie is beneficial from a temperature standpoint in that the Lake helps to moderate temperature extremes in both winter and summer. But moisture from the lake also creates very high volumes of snow and at times ice in the winter. The weight of the snow and ice itself can cause significant structural damage to trees (Photo 9.1a). Therefore, when choosing tree species for planting, it is important to chooses species and varieties that characteristically have strong wood and branching patterns that do not result in narrow

Photo 9.1a: Buffalo's climate brings significant snowfall and occasional ice storms, which can damage trees. Proper selection of tree species that can withstand such conditions is crucial.

branch angles with included bark. Species that hold onto foliage late into the fall should also be avoided since snow and ice will accumulate on leaves causing tremendous loads.

A serious problem for trees that is created by the abundance of snow is the high volume of salt used each winter on Buffalo streets. Extremely high concentrations of salt accumulate adjacent to streets making a very difficult environment for trees to survive. When selecting tree species for street tree planting, it is very important to choose salt resistant species and varieties.

Many of Buffalo's streets have narrow tree lawns (the space between sidewalks and curbs). Other streets, particularly in commercial districts do not have tree lawns, but require cutouts in concrete sidewalks to create planting sites. These narrow, small soil volume sites will not accommodate large-growing trees. Large trees in inadequate spaces ultimately result in damage to both the adjacent hardscape and to the tree.

Trees that are planted in concrete cutouts in sidewalks are also subject to higher soil pH conditions due to the gradual accumulation of concrete dust and alkaline runoff (Photo 9.1b). Soil pH should be tested in these areas before selecting a tree species to be planted. In some cases, alkaline tolerant species may be required.

Photo 9.1b: Street trees surrounded by concrete and asphalt are subject to temperature extremes, toxic runoff, alkaline soils, salt sprays and compacted soils.

In addition to all of the climate and site-specific conditions that must be factored into the choice of street trees for Buffalo, species diversity must also be considered. As discussed in the inventory review section of this plan, Buffalo has two genera that are over-represented in Buffalo's urban forest. The genus *Acer* (maple) comprises nearly half (47%) of the street trees, and *Tilia* (linden) makes up 21% of the population. To avoid catastrophic losses of trees from a species-specific insect or disease (such as Dutch elm disease) it is important to diversify the urban forest. Maples are attacked by Asian Longhorned Beetles and ashes are devastated by the Emerald Ash Borer. These insect pests could seriously decimate Buffalo's tree population.

In summary, when choosing tree species to plant along Buffalo streets, the following factors should be considered:

- Climate – Look for cold hardy varieties.
- Structure – Plant trees with strong wood and wide branch attachments that can accommodate heavy snow and ice loading. Avoid species with late leaf drop.
- Salt tolerance – Select trees that will survive salt concentrations in soil and salt spray.
- Limited space – Install trees that will fit into the available space when mature. Consider space for roots, crown spread, and crown height.
- pH – Remember that spaces surrounded by concrete can have elevated pH, and alkaline tolerant species may be needed.
- Species diversity – Avoid species that are currently over-planted (maples and lindens), and genera such as ashes that are targets of severe insect pests (Emerald Ash Borer).

Appendix B presents a list of recommended tree species for Buffalo.

9.2 Reforestation Via Comprehensive Planning– Prioritization of Construction Projects

The City of Buffalo's most recent draft comprehensive plan, Queen City in the 21st Century, promotes directing redevelopment in designated Investment Corridors. These corridors are illustrated in Figure 9.2a. The investment corridors encompass major development hubs, zones and thoroughfares, and the Olmsted parks and parkway system. Development will be both encouraged and directed to these areas and will receive higher priority status in terms of administrative support and funding. Citywide reforestation efforts can be directed within these areas to complement localized capital improvement and infrastructure upgrades.

The most immediate opportunities for reforestation is to coordinate street tree planting with construction activities as they are undertaken by the City's Planning and Engineering departments.

There are several projects that will take place in the spring and summer months of 2003 that will involve construction of new sidewalks, buildings, and/or parking lots. Sites for trees at each of these projects should be planned in advance of construction start-up.

9.2.1 Connecticut Street

Connecticut Street between Niagara Street and Richmond Avenue is being developed as the New World Street Market. Pushcart vendors will attract pedestrian shoppers to the area. The streetscape will be improved with trees and vacant lots along the street may be landscaped. Many planting sites for new trees will be available. Construction is scheduled to begin in spring of 2003.

Strategic Investment Corridors

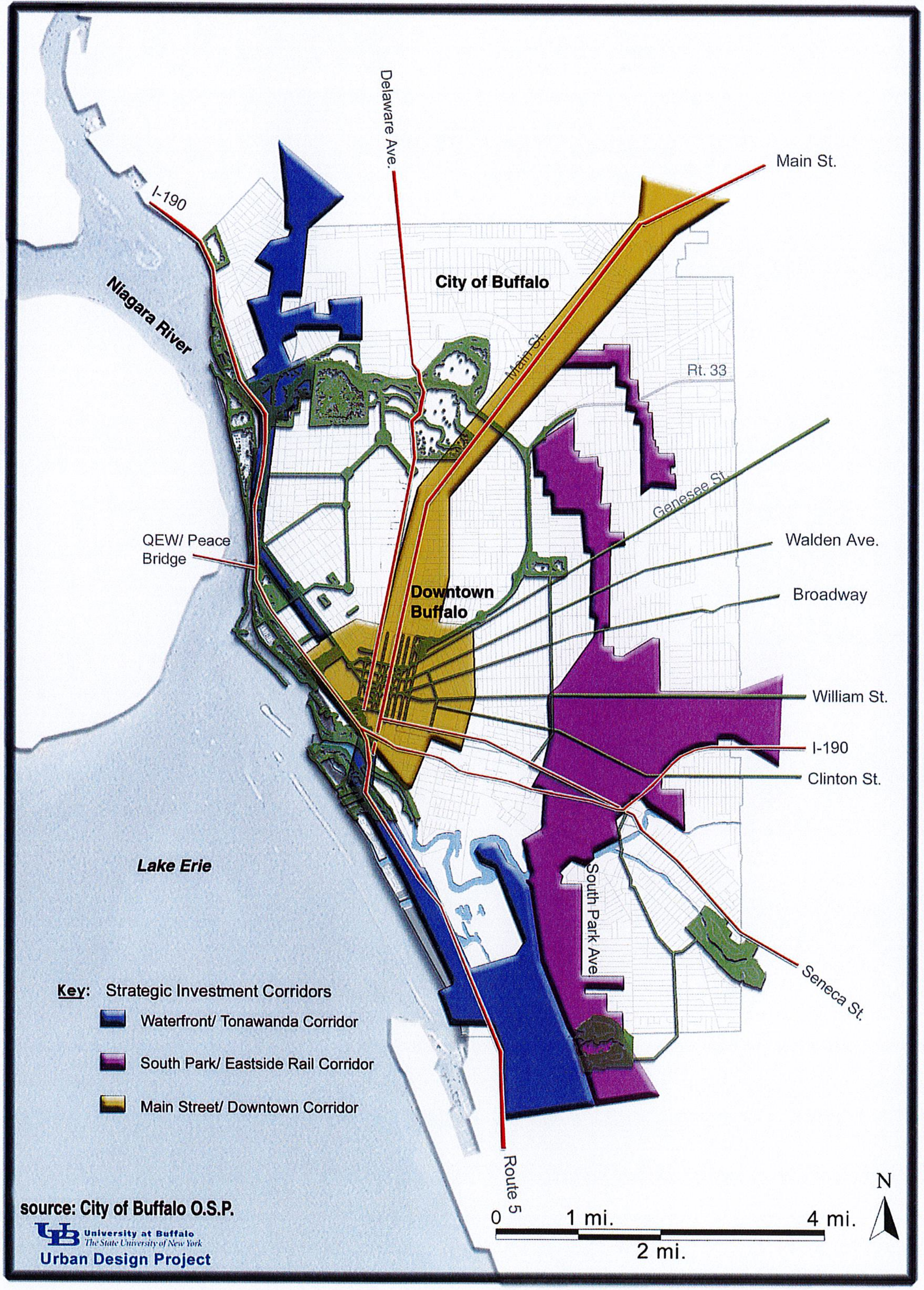

Figure 9.2a: Strategic investment corridors.

9.2.2 College Campuses

D'Youville College, located at Niagara Street and Porter Avenue is scheduled to have construction that affects sidewalks starting in spring of 2003. Similar construction will take place at Canisius College along Main Street north of Delavan Avenue.

9.2.3 Housing

There are several home ownership zones in Buffalo. Federal and state funding is used in these areas to revitalize residential neighborhoods. Two such neighborhoods, Willert Park and Cold Springs will undergo construction activities during the summer of 2003.

9.2.4 School Reconstruction

Nine of Buffalo's public schools are scheduled to undergo construction to bring them up to local building codes. Included in this construction is a plan for new sidewalks. Tree planting opportunities will be available at these schools, although it is recommended that trees should be no smaller than 3 inches in diameter at the time of planting to discourage students from trying to snap stems. As with all schools, a tree benefit awareness campaign taught through the school's science classes should precede tree planting.

9.2.5 SUNY Buffalo Medical Campus

The medical campus of SUNY Buffalo will undergo construction that may involve sidewalks during the summer of 2003. Contacting the campus planning department may uncover opportunities for tree planting on both city and university property. Coordinating efforts will likely result in cost savings to both agencies.

9.2.6 Tops Supermarkets

Two new Tops supermarkets are scheduled to be built in Buffalo during 2003. The first will be located at Niagara Street between Maryland and Hudson streets, and the second will be built at Jefferson Avenue and Riley Street.

9.3 Prioritization of Residential Street Tree Planting

Tree planting in residential neighborhoods is an extremely important component to Buffalo's reforestation objectives for several reasons. First, the vast majority of sites suitable for growing trees along streets exist in front of single family homes (Photo 9.3a). Second, most of the highest quality (largest) sites are in residential areas. And finally, homeowners are generally more likely to care for trees growing in front of their property than commercial or industrial landowners; therefore trees in neighborhoods have a longer expected lifespan than street trees in non-residential areas. Because of this, tree-planting projects in residential neighborhoods may realize the greatest return on investment.

....homeowners are generally more likely to care for trees growing in front of their property than commercial or industrial landowners; therefore trees in neighborhoods have a longer expected lifespan than street trees in non-residential areas. Because of this, tree-planting projects in residential neighborhoods may realize the greatest return on investment.

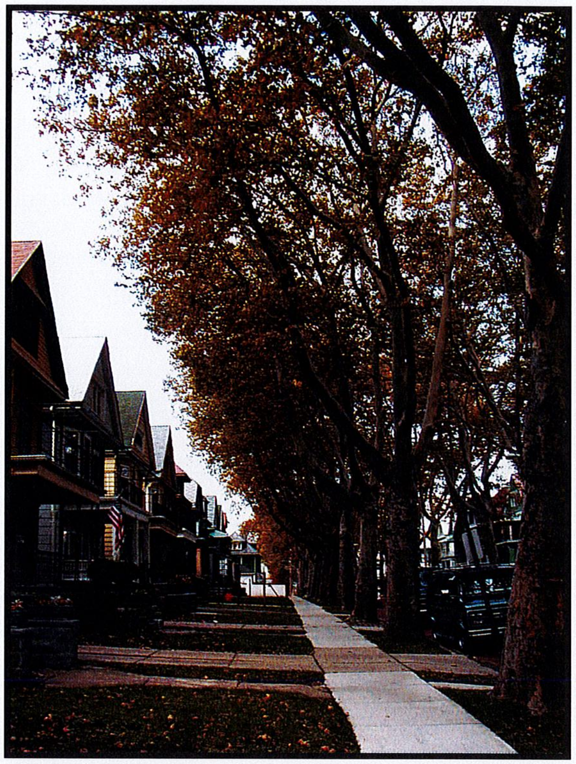

Photo 9.3a: Trees along residential streets typically have more growing space than those in commercial or industrial areas. Adequate growing space combined with irrigation supplied by residents help trees to reach maturity. Large trees provide greater benefits than trees that don't live long enough to reach maturity.

Trees are frequently planted at the request of the homeowner. It is beneficial for the public support that results from responding to these requests that the forestry bureau continue to be responsive. But similar to responding to tree removals and prunings on an emergency basis, single tree plantings conducted in response to requests is not as cost effective as conducting planned plantings in a targeted area. It is also difficult to achieve consistency in a landscape theme, both in terms of species and size when tree plantings are done as isolated events instead of planned projects. Just as a cycle of routine pruning will reduce the need for emergency removals and pruning, a system of routine reforestation will result in greater efficiency, lower installation costs and a reduction of landowner requests for trees to be planted.

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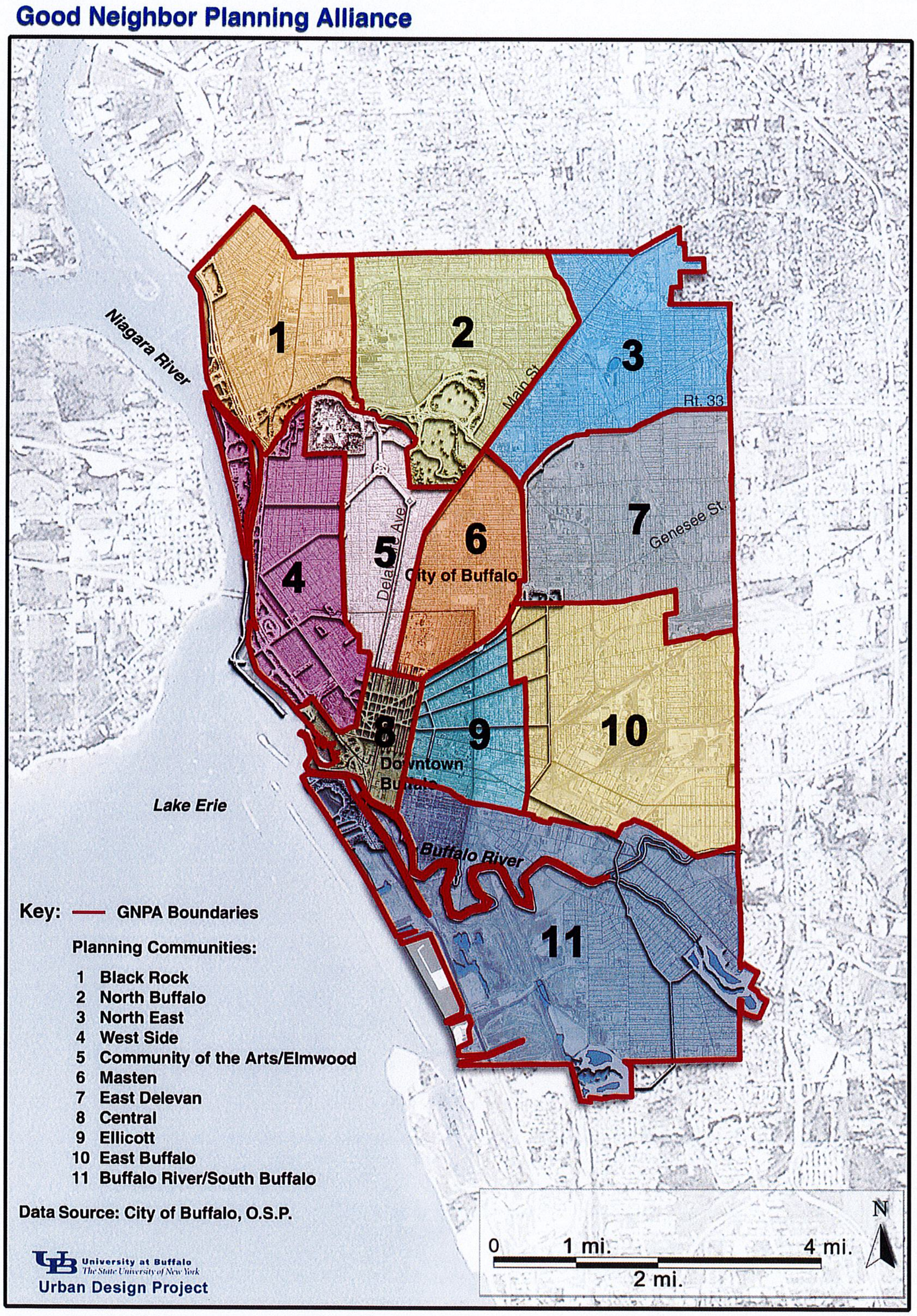
Recognizing the magnitude of the task of planting 23,000 street trees to achieve 85% stocking, a well-defined plan is needed to achieve success. The specific tasks of the plan are outlined in section 9.5 of this document. However, it is appropriate in this section to address the question "Where do we start?"

Prioritizing a neighborhood tree planting plan begins with identifying the neighborhoods with the most suitable sites. This can be done by examining the 2002 tree inventory data and listing the available planting sites in order of decreasing size. From this point it is useful to further identify those sites that are not constrained by utility line restrictions.

Site size is only one variable to consider, however. Next, it is useful to identify which neighborhoods have a strong base of support from the residents for tree-planting projects. This information may not already be available, and may require additional investigation. One way to obtain an indication of neighborhood support is to conduct a public information campaign designed to share the findings of this Master Tree Plan followed by an invitation to request neighborhood trees. Points of such a publicity campaign might include:

- The City of Buffalo has over 67,600 street trees that give the city cleaner air, conserve energy, and make our neighborhoods better places to live.
- The City of Buffalo looses more trees each year than are planted. To help revitalize Buffalo, this trend must be reversed.
- To increase the benefits that trees provide to our city, the new Master Tree Plan calls for increasing our street tree population to over 90,000 trees within 10 years.
- We need the help of Buffalo's citizens to make the reforestation project a success. For more information on how your neighborhood, church, school, or non-profit organization can request that trees be planted along your streets call (insert phone number) or visit www.(insert web site).

The city's comprehensive planning process employs a structure devised by the Buffalo Good Neighbors' Planning Alliance (GNPA) to coordinate neighborhood planning and redevelopment initiatives. As illustrated in Map 9.3b, the GNPA includes 10 planning areas, plus the central business area, organized by citizen committees. The GNPA groups may elect to serve in the future as facilitators of community tree planting and stewardship to coordinate such efforts with the City Forestry Bureau and Green Fund.



Map 9.3b: Community management units used for planning purposes by the Good Neighbor Planning Alliance.

If block clubs or groups of homeowners are not organized, other groups such as churches, schools, non-profits, and youth organizations (scouts, athletic clubs, etc.) are excellent sources of open minds and enthusiastic support. It is important to note that neighborhood groups are not being asked for financial contributions or labor (although inviting volunteers to help with planting can result in strong support for a city's urban forestry program). But rather the groups are being identified and educated so that they can develop a sense of stewardship for their neighborhood urban forest.

This approach for local stewardship of trees has a history of success in Buffalo. The Reforest Buffalo Coalition recently reported on the past and future efforts of the citizens volunteer group Reforest Buffalo:

> *Reforest Buffalo identified the Olmsted Parks and Parkway system as the starting point for volunteer tree planting efforts within the City of Buffalo. Hundreds of volunteers utilizing the bare root tree planting method were able to reforest whole sections of the Olmsted system.*
>
> *There are six main Olmsted Parks in Buffalo with a seven interconnecting roadway system called "parkways" and seven circles between them. As of this writing, Reforest Buffalo has completed reforesting Delaware Park (1,500 trees), Martin Luther King Park (1,000 trees), McKinley, Red Jacket, Humboldt and Jewett Parkways as well as intersecting streets such as South Park, Fillmore, Best, North Parade and East Parade. In the spring of 2003, the plan is to plant 200 trees in Cazenovia Park.*

To duplicate this level of success, up-front organization is essential. Future tree planting projects involving volunteers to care for trees following planting by the city should be prioritized by location and by level of grass roots networks already in place. As neighborhoods are identified, public meetings are then scheduled to promote the reforestation plan and to encourage participation by caring for the new trees after they are planted. Information of watering, mulching and pruning should be distributed. Additional effort should be made to visit local schools to educate students on the benefits of trees. This effort can be in conjunction with Arbor Day activities and will certainly result in lower vandalism rates.

Tree-planting projects should not be scheduled or prioritized by political district. Rather tree-planting projects can be scheduled with consideration of the new urban forestry management areas as described in section 7.0 of this document. It may be useful to complete one neighborhood tree-planting project in each of the urban forest management areas before returning to the management area of the first project.

The final consideration in prioritizing residential tree planting projects is to decide what tree species are best suited for the environmental and infrastructure conditions of the targeted streets. All of the desired tree species and/or sizes of trees may not be immediately available. Therefore it may be necessary to reprioritize the order in which neighborhoods will be scheduled to accommodate the availability of stock.

In summary, prioritization of planting projects in residential neighborhoods will consider the following criteria:

- Sort vacant sites by growing size and overhead/underground obstructions. Identify neighborhoods with the largest number of the most suitable sites as candidates for immediate planting.
- Use a public relations campaign to invite requests by neighborhood groups, churches or schools for trees to be planted.
- Try to identify suitable neighborhoods with good public support in each of the new Urban Forest Management Areas to achieve geographic distribution of trees. Do not use political districts to schedule neighborhood planting projects.
- Identify the appropriate tree species that are currently available from commercial nurseries and match them to the best neighborhood sites.

9.4 Tree Planting Standards

Landscape trees typically exhibit the highest mortality rates in the first three years following planting. The most common reasons for newly planted trees to die include:

- Improper planting depth (more often too deep than too shallow)
- Improper watering (more often too little but could also be too much)
- Girdling by rope attached to burlap or wires attached to stakes (flexible, loosely attached straps are preferred)
- Vandalism

To achieve the highest survival rates for newly planted trees, it is critical that proper planting methods be followed. Appendix D presents recommended planting methods for Buffalo's street trees.

Extra effort is needed when planting trees in small spaces including concrete cutouts, raised planters and parking lot islands (Photo 9.4a). These sites typically have very low soil volume, compaction problems, little or no irrigation and poor drainage. Researchers at Cornell University, Virginia Tech and other institutions have published articles on engineered soils and planting methods for

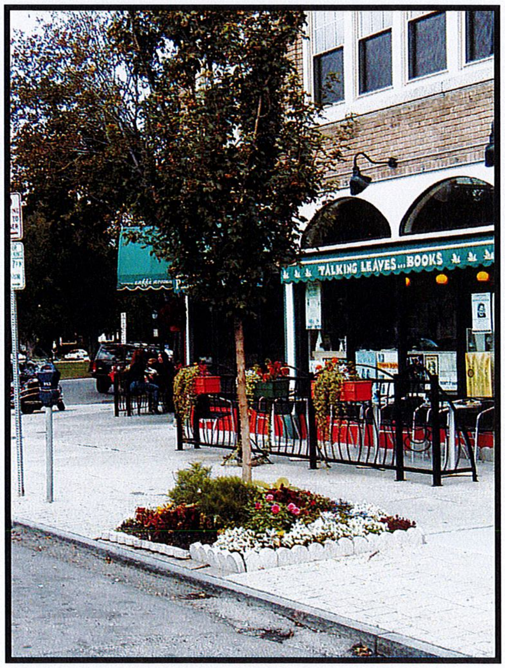


Photo 9.4a: Trees selected for placement in small concrete cutouts may benefit from drainage tiles and installed irrigation systems.

challenging urban sites. A reference list of these publications is presented in Appendix E.

An Arboricultural Standards Manual for the City will include detailed planting specifications. The following spacing, site size and grade requirements are examples of the type of information to be included in an Arboricultural Standards Manual that can be easily updated as new research is published:

Minimum spacing requirements for street trees:
- 15' minimum spacing from utility/light poles, fire hydrants, utility boxes.
- 45' minimum distance from corner with stop sign/light present.
- 35' minimum distance from corner without stop sign/light present.
- 3' minimum distance from underground utility lines, water access cover.
- 40' minimum spacing for large trees, 30' for medium, 20' for small trees.
- Trees are not to be planted in front of vacant lots.

Minimum site size requirements for street trees:
- Tree pits should be have at least 35 square feet of surface such as 6'x6', or 4'x7', unless structural soil is used, then tree pits may decrease to a minimum of 20 square feet of surface area, such as 4'x5'.
- Planter boxes should have no less than 16 square ft of surface area for small trees (4'x4'), and should be regularly irrigated.
- Planter boxes for shrubs should have no less than 9 square feet of surface area (3'x3'), plus irrigation.

All trees to be planted as street trees should follow all acceptable nursery standards including:
- Street grade trees only.
- No damage to trunk or leaders.
- Strong central leaders on trees.
- Accepted caliper size is 2" - 3", with 24" and 36" root balls respectively, no trees larger than 3" caliper.
- 6' minimum branching for shade trees, 4' minimum branching for ornamentals. Clump forms only accepted for shrubs, 6' minimum.

9.5 10-Year Street Tree Planting Plan

The 2001 street tree inventory tallied 106,715 sites along Buffalo streets that have been used to grow trees. Of these, 5,172 sites were identified as being inappropriate for future plantings, leaving 101,543 suitable sites. As of the completion of the 2001 inventory, there were 67,647 trees growing along Buffalo's streets meaning that approximately 67% of the suitable spaces are occupied. In order to meet the goal of having at least 85% of the suitable spaces filled with trees, an additional 18,700 will need to be planted.

Obviously, all 18,700 trees will not be immediately planted. Indeed, it is an ambitious (but doable) plan to plant this many trees in 10 years. But this is not the total number to plan for in order to reach 85% stocking. As discussed in section 8.5 of this master plan, a large number of trees identified for removal in the 2001 inventory will need to be removed over the next five years. In addition to these scheduled removals, it is reasonable to expect a 2% annual mortality rate for the street tree population (a 2% mortality rate assumes an average life expectancy of 50 years for a street tree.) Therefore, a plan that achieves a goal of 85% stocking within ten years must also account for replacing tree removals in addition to making progress on currently vacant sites.

Table 9.5a outlines the number of trees to be planted to replace scheduled removals (as presented in Section 8.5) plus the number of trees needed to be planted over a ten year period to achieve 85% stocking along streets.

Year	# of plantings due to removals	# of additional plantings	Total street trees planted for year	Projected street tree population	% stocking of acceptable sites
1	1,715	1,870	3,585	69,517	68.5
2	1,715	1,870	3,585	71,387	70.3
3	1,715	1,870	3,585	73,257	72.1
4	1,910	1,870	3,780	75,127	74.0
5	1,315	1,870	3,185	76,997	75.8
6	1,315	1,870	3,185	78,867	77.7
7	1,315	1,870	3,185	80,737	79.5
8	1,315	1,870	3,185	82,607	81.4
9	1,315	1,870	3,185	84,477	83.2
10	1,315	1,870	3,185	86,347	85.0
Total	14,945	18,700	33,645		

Table 9.5a: Projected number of trees to be planted along streets in order to achieve 85% stocking of suitable sites in 10 years. Includes replacement of trees currently identified as removals and assumes 2% annual mortality.

9.6 Work Force Options

Given the current size of Buffalo's Forestry Bureau and the work load necessary to maintain existing public trees, it will be difficult to schedule the number of work hours needed to plant more than 3,000 trees annually for the next ten years. Therefore, the labor needed to plant many of the trees must come from other sources. One possible, but unlikely source of labor is from other municipal departments. This option is not desirable because the work would be conducted by laborers not trained in tree planting, and the cost would be as much (or more do to lower productivity) than if Forestry Bureau personnel were performing the work. A second option is to contract some tree planting tasks out to private companies. The quality of the work could be ensured as part of the contract, but municipal inspectors would still be needed and the cost would likely be higher than using city employees.

A third option is available, and this option has the most potential benefits. Volunteers have been successfully recruited to plant trees in public spaces for several years. Examples of volunteer tree planting projects organized by non-profits groups such as Reforest Buffalo include:

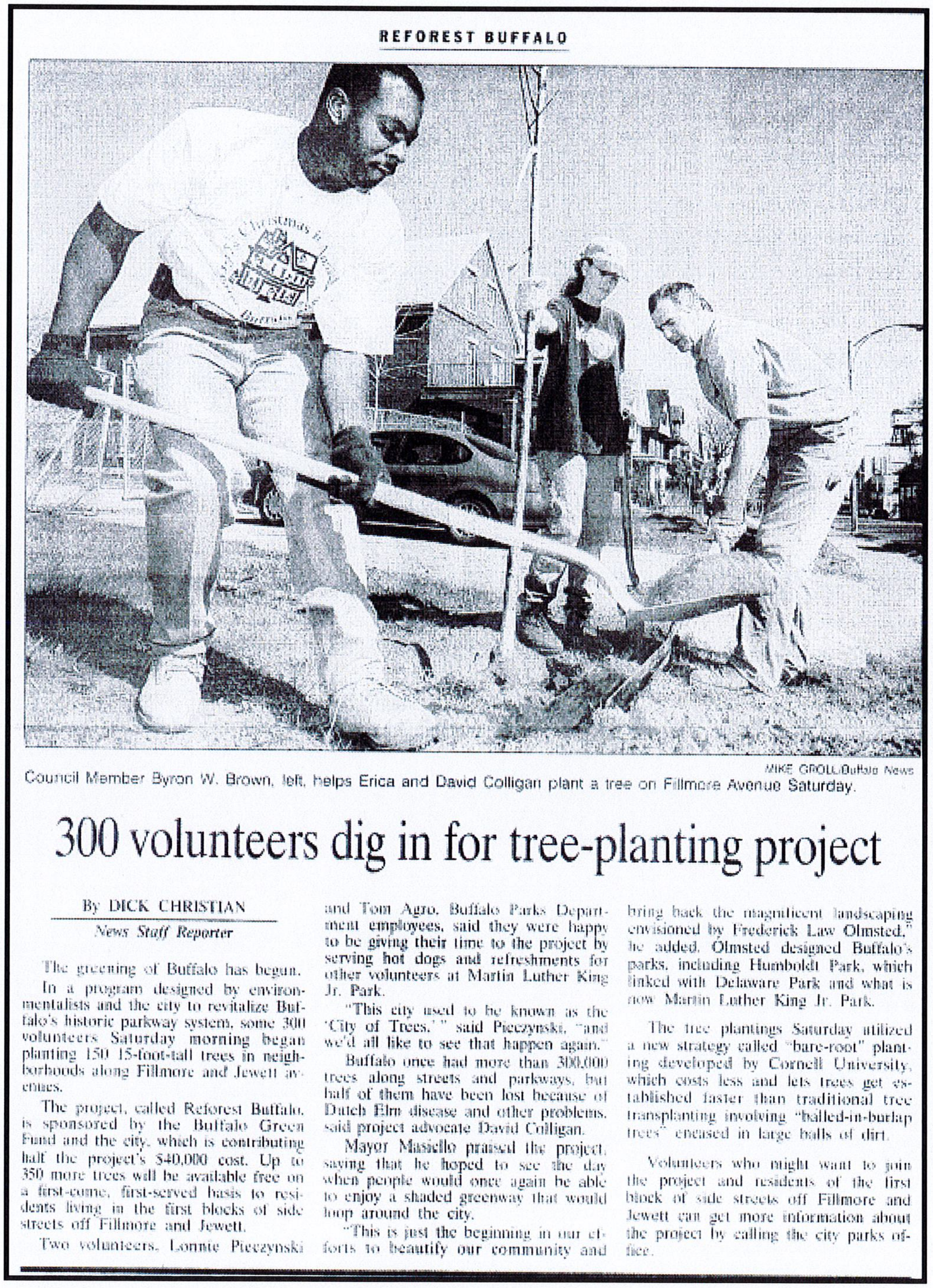
- In the spring of 1999, volunteers planted 100 trees in neighborhoods along Filmore and Jewett Avenues. The City of Buffalo funded half of the $40,000 needed to complete the project and the Buffalo Green Fund organized the event.
- In the fall of 1999 volunteers planted 100 trees along Jewett Parkway.
- In the spring of 2000, 750 volunteers planted 750 trees and shrubs in Martin Luther King Jr. Park. The Buffalo Olmsted Parks Conservancy sponsored the event with assistance from the City of Buffalo and a wide range of community groups including the Buffalo Green Fund.
- In the fall of 2000, volunteers planted 100 trees on South Park Avenue.
- In the spring of 2001, volunteers planted 250 trees in Martin Luther King Park and 750 trees in Delaware Park.
- In the fall of 2001, volunteers planted 150 trees along McKinley Parkway and Red Jacket Parkway.
- In the spring of 2002, volunteers planted 500 trees in Delaware Park.
- In the fall of 2002, volunteers planted 100 trees along Humboldt Parkway.
- In the spring of 2003, 200 volunteers participated in planting 200 trees at Cazenovia Park.
- Planned for the summer of 2003 is a tree volunteer tree-planting project along Washington Street in downtown Buffalo organized by the community action organization Buffalo Place.

Involving volunteers with tree-planting projects pays larger dividends than providing free labor, although that contribution cannot be overlooked. Involving volunteers certainly benefits the trees themselves. When volunteers plant trees, they make an investment of themselves into the project. People who have participated in planting the trees will be more likely to care for the trees once they are in the ground. People that have planted trees in their own neighborhood are more likely to keep watch of the trees, resulting in lower incidence of vandalism and theft. By involving residents in planting and caring for trees, the city is also building avenues of communication and education with the community.

Involving volunteers with tree-planting projects pays larger dividends than providing free labor....When volunteers plant trees, they make an investment of themselves into the project.

Tree planting projects that involve volunteers also gain favorable coverage from the news media, which gets the message of the benefits of trees delivered throughout the larger community (Figure 9.6a). Neighborhoods that witness the improvement of adjacent areas through the addition of trees are more likely to adopt the attitude of "Let's do that too!"

Volunteers affect the financial well-being of urban forestry programs in several ways. First, the labor of planting the trees saves the municipal government funding in an already-lean budget, allowing for more money to be available for tree maintenance. Just as importantly, volunteer labor can be used as an in-kind match for many grants, such as those administered by the National Urban and Community Forest Advisory Council (NUCFAC). Also, non-profit organizations such as Buffalo Green Fund can apply for grants from many foundations and trusts. By demonstrating a strong level of participation from volunteers, these non-profit groups are much better positioned to successfully acquire grants.



REFOREST BUFFALO

MIKE GROLL/Buffalo News

Council Member Byron W. Brown, left, helps Erica and David Colligan plant a tree on Fillmore Avenue Saturday.

300 volunteers dig in for tree-planting project

By DICK CHRISTIAN

News Staff Reporter

The greening of Buffalo has begun.

In a program designed by environmentalists and the city to revitalize Buffalo's historic parkway system, some 300 volunteers Saturday morning began planting 150 15-foot-tall trees in neighborhoods along Fillmore and Jewett avenues.

The project, called Reforest Buffalo, is sponsored by the Buffalo Green Fund and the city, which is contributing half the project's $40,000 cost. Up to 350 more trees will be available free on a first-come, first-served basis to residents living in the first blocks of side streets off Fillmore and Jewett.

Two volunteers, Lonnie Pieczynski and Tom Agro, Buffalo Parks Department employees, said they were happy to be giving their time to the project by serving hot dogs and refreshments for other volunteers at Martin Luther King Jr. Park.

"This city used to be known as the 'City of Trees,'" said Pieczynski, "and we'd all like to see that happen again."

Buffalo once had more than 300,000 trees along streets and parkways, but half of them have been lost because of Dutch Elm disease and other problems, said project advocate David Colligan.

Mayor Masiello praised the project, saying that he hoped to see the day when people would once again be able to enjoy a shaded greenway that would loop around the city.

"This is just the beginning in our efforts to beautify our community and bring back the magnificent landscaping envisioned by Frederick Law Olmsted," he added. Olmsted designed Buffalo's parks, including Humboldt Park, which linked with Delaware Park and what is now Martin Luther King Jr. Park.

The tree plantings Saturday utilized a new strategy called "bare-root" planting developed by Cornell University, which costs less and lets trees get established faster than traditional tree transplanting involving "balled-in-burlap trees" encased in large balls of dirt.

Volunteers who might want to join the project and residents of the first block of side streets off Fillmore and Jewett can get more information about the project by calling the city parks office.

Figure 9.6a: This article from the May 2, 1999 edition of the Buffalo News illustrates the positive press coverage that typically follows volunteer tree-planting projects.

9.7 Budget

The goal of planting 33,700 street trees over the next 10 years will be accomplished through a combination of efforts provided by the City of Buffalo, non-profit organizations, and organized volunteer groups. The cost of planting these trees could be highly variable depending on the costs of the trees and associated materials (mulch, stakes, equipment), and the cost of the labor. The Forestry Bureau reports that it costs approximately $185 - 250 for municipal crews to plant a street tree. A tree planted by volunteers, in contrast, costs approximately $65 - $75. This is obviously due to reduced labor costs, but also due to the fact that most trees that have been planted by volunteers in Buffalo are smaller and are delivered bare-root as opposed to the larger balled-and-burlapped trees typically purchased for installation by municipal crews.

Table 9.7a projects the costs for planting the targeted number of trees over the next ten years in two scenarios. The first scenario projects costs for all trees to be planted by municipal employees and/or contractors. The second scenario projects costs for half of the needed trees to be planted by volunteers.

Year	Total street trees planted for year	Scenario 1: All trees planted by municipal labor @ $220/tree	Scenario 2: 50% trees planted by volunteer labor @ $70/tree	Projected savings by utilizing 50% volunteer labor
1	3,585	$788,700	$519,825	$268,875
2	3,585	$788,700	$519,825	$268,875
3	3,585	$788,700	$519,825	$268,875
4	3,780	$831,600	$548,100	$283,500
5	3,185	$700,700	$461,825	$238,875
6	3,185	$700,700	$461,825	$238,875
7	3,185	$700,700	$461,825	$238,875
8	3,185	$700,700	$461,825	$238,875
9	3,185	$700,700	$461,825	$238,875
10	3,185	$700,700	$461,825	$238,875
Total	33,645	$7,401,900	$4,878,525	$2,523,375

Table 9.7a: Projected costs for planting the required number of trees to reach 85% stocking along streets within 10 years.

9.8 Working Relationships with Nurseries

The Forestry Bureau has a good working relationship with local nurseries. Gleason's Nursery provides most of the balled-and-burlapped tree stock, and the consistent quality backed up by a one-year guarantee has proven to be beneficial to the longevity of street and park trees. Bare root nursery stock is provided primarily from Schichtel's Nursery. Schichtel's preference for shipping bare-root stock is somewhat unusual in the industry, and has proven to be helpful to the goal of getting larger numbers of trees in the ground within a limited budget.

The Forestry Bureau is wise to develop long-term relationships with local nurseries for several reasons. First, because of Buffalo's harsh winter climate, nursery stock that originates in the Lake States or southern Ontario is best suited for city tree-planting projects. And second, with a goal of almost 3,400 trees planted annually for ten years, the City will need a dependable supply of trees. Because of this sizeable need, the City of Buffalo becomes a very important client for regional nurseries. With a ten-year planting plan in place, Davey Resource Group recommends that the Forestry Bureau present the list of recommended species to regional nurseries so that adequate supplies of a diverse range of tree species can be grown in time to meet planting schedules. It may be to the City's advantage to have trees grown on a contract basis so that the precise number, quality and size specifications are guaranteed.

10.0 Establishment of a Tree Board

The City of Buffalo is fortunate to have many dedicated professionals and volunteers that all have an interest in the urban forest. The source of interest for these individuals lies in a wide range of values that is as diverse as the benefits that trees provide to the city (see Section 1.0 of this document). For some, the environmental benefits of clean air and water are of primary concern, and the related issues of public health strengthen people's commitment to growing trees. For others, the economic benefits that trees provide to the community, such as increased property value, attracting business or decreased energy costs are the principal reasons for promoting urban forests. For most people, the simple beauty of trees is enough reason to get involved with planting and preservation projects. No matter what the reason for participation, dedicated individuals can make a significant impact to the improvement of Buffalo's environmental and economic health.

...dedicated individuals can make a significant impact to the improvement of Buffalo's environmental and economic health.

Many communities have benefited from the establishment of a tree board to assist in tree-related matters. Other communities have found the creation of a tree board to create more problems than it solves. The key to success in forming a tree board is developing a clear scope of the roles and responsibilities of the board, and equally important is the need to identify what falls outside of the scope of responsibilities. Most successful tree boards function in an advisory capacity. Few have enforcement responsibilities.

The makeup of a tree board is critical to its success, both in terms of the individual people and the organizations that are represented. When assembling a tree board for the first time, it is often helpful to create a list of the reliable citizen advocates that have supported the urban forestry program in the past. Those individuals and the groups they represent are likely to be a good starting point for listing the organizations that should be represented.

When creating a tree board it is advisable to outline in a draft charter the number of members that will participate and the groups that shall be represented. Organizations that may be desirable for representation include:

- The city forester's office (typically the City Forester or Arborist is a permanent member of the tree board)
- The Planning Department
- The local electric utility company
- Local volunteer groups
- Local neighborhood organizations

- A local business person
- A representative of the green industry (such as tree care, nursery, or landscaping company)
- An educator from a related field (forestry, arboriculture, urban planning, etc.)

Keeping the number of board members to a manageable size is desirable, and 7 to 11 participants usually works well. An odd number may be desirable so that votes on motions do not end in ties. Additional people can be brought in as non-voting members to serve on committees or task groups.

Terms of board members should be kept relatively short to prevent burnout. A two-year term with an option for nomination for an additional two-year term is advisable. Staggering the terms of board members allows new members to be brought in under the guidance of experienced board members.

While most tree boards serve in an advisory capacity, it is highly recommended that the roles and responsibilities be formalized in writing. Before the Tree Board is officially recognized, it is useful to bring likely participants together to draft a charter and mission statement. The charter for a tree board should then be submitted to City Council for approval.

Meetings are usually where ideas are presented and work gets done. Tree board meetings can be informal forums for sharing information and exploring new ideas, but it is important to have an established system of debate and voting when the time is appropriate. Roberts Rules of Order is the most commonly used system of parliamentary procedure, and can easily be adopted to facilitate orderly discussion for tree boards.

The roles and responsibilities of tree boards can be as broad or focused as needed. Typical roles and responsibilities include:

- Public education including organizing Arbor Day events
- Fund raising
- Organizing tree planting events
- Crafting draft ordinances for review by the City Forester and submission to City Council
- Providing arbitration services in tree related disputes
- Gathering current information on arboriculture and updating the Arboricultural Standards Manual

It is not advisable to burden the tree commission with enforcement powers. Tree commissions are not effective as tree police, and unwanted confrontations certainly arise when commissioners take it upon themselves to enforce ordinances. Tree commissions can be effective in arbitrating disputes between parties. Pressure can be dispelled from the City Forester's office if the tree commission is employed to make final decisions on disputes involving tree removals and development violations involving trees.

Additional information on tree commissions can be found in Appendix F.

Urban Forest Master Plan

for

the City of Buffalo, New York

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